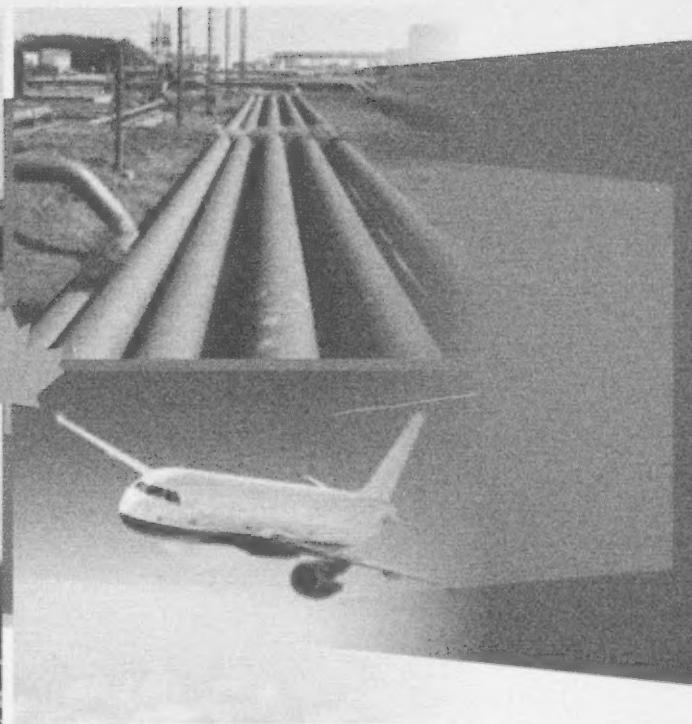
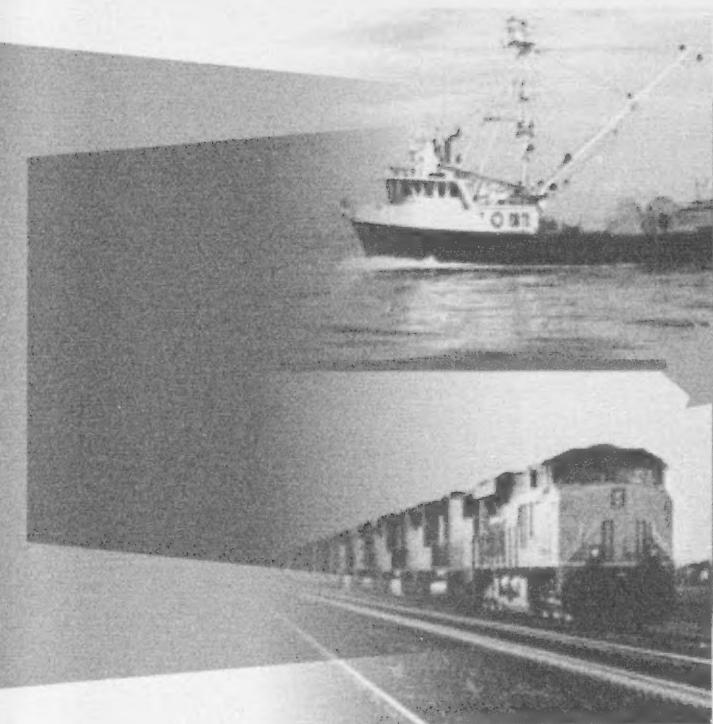




Transportation  
Safety Board  
of Canada

Bureau de la sécurité  
des transports  
du Canada



# 2013-14

*Annual Report to Parliament*

*From coast to coast to coast*

Canada

Transportation Safety Board of Canada  
Place du Centre  
200 Promenade du Portage, 4th floor  
Gatineau QC K1A 1K8  
819-994-3741  
1-800-387-3557  
[www.tsb.gc.ca](http://www.tsb.gc.ca)  
[communications@bst-tsb.gc.ca](mailto:communications@bst-tsb.gc.ca)

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Cat. No. TUI-2014E-PDF  
ISSN 1704-1120

ANNUAL REPORT TO PARLIAMENT 2013-2014

Place du Centre  
200 Promenade du Portage, 4th floor  
Gatineau, Quebec K1A 1K8

20 August 2014

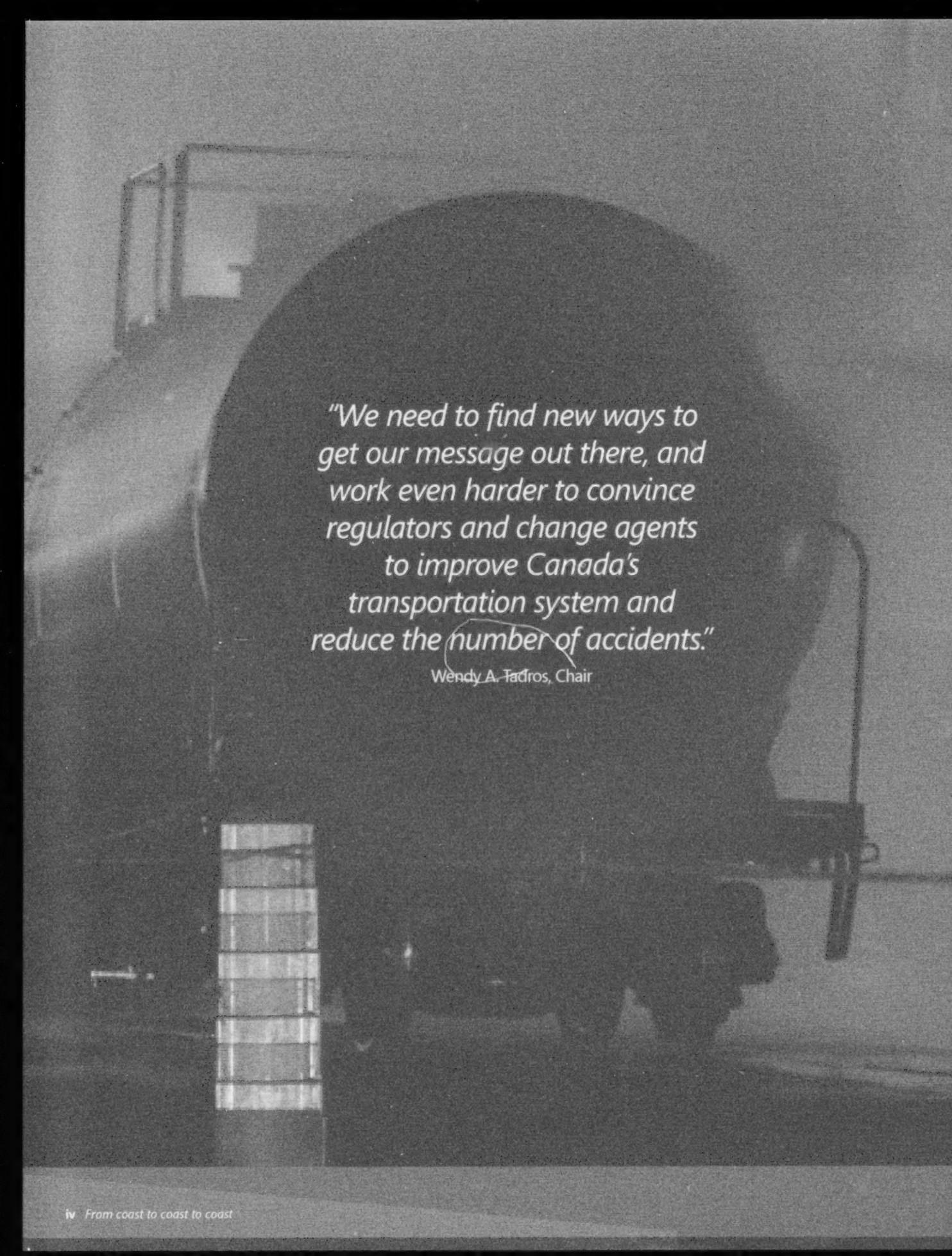
The Honourable Peter Van Loan, P.C., M.P.  
Leader of the Government in the House of Commons  
House of Commons  
Ottawa, Ontario K1A 0A6

Dear Minister,

In accordance with subsection 13(3) of the *Canadian Transportation Accident Investigation and Safety Board Act*, the Board is pleased to submit, through you, its Annual Report to Parliament for the period of April 2013 to 31 March 2014.

Yours sincerely,

*Original signed by*  
Wendy A. Tadros  
Chair



*"We need to find new ways to  
get our message out there, and  
work even harder to convince  
regulators and change agents  
to improve Canada's  
transportation system and  
reduce the number of accidents."*

Wendy A. Tadros, Chair

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# *Message from the Chair*

**Canada is a vast country, and the transportation network we rely on is just as immense. This means accident investigators from the Transportation Safety Board of Canada (TSB) must be prepared to travel anywhere, at any time—from coast to coast to coast. That's because no matter where something goes wrong—on our waterways, along our pipelines or railways, or in our skies—it's our mission to find out what happened, and why, so that steps can be taken to make sure it doesn't happen again.**

This past year, we delivered on that promise with dozens of investigation reports from every corner of our nation—whether it was an air accident in Resolute Bay, a vessel collision on Vancouver Island, or an aircraft overrun in St. John's. We also started investigations in just as many regions—from the collision of a Cessna and a glider on the British Columbia coast, to the crash of a Canadian Coast Guard helicopter in M'Clure Strait, Northwest Territories, to an accident involving a large bulk carrier in Rose Blanche, Newfoundland and Labrador.

Among those investigations is one that has gripped both the country and the world—the deadly rail disaster at Lac-Mégantic, Quebec. That tragedy, in fact, has become a flashpoint, highlighting the safety of our rail network as a key national issue. Canadians from Saint John, to Winnipeg to Vancouver are paying attention to the risks of shipping dangerous goods through their towns and cities, and along their lakes and rivers. And they want assurances it will be done safely.

With the stakes higher than ever, we go to great lengths to make sure our reports are based on painstaking examination of the evidence, detailed analysis, and the scientific rigour brought to bear by highly trained experts. To ensure we get it right, we must take the time necessary to complete our work so

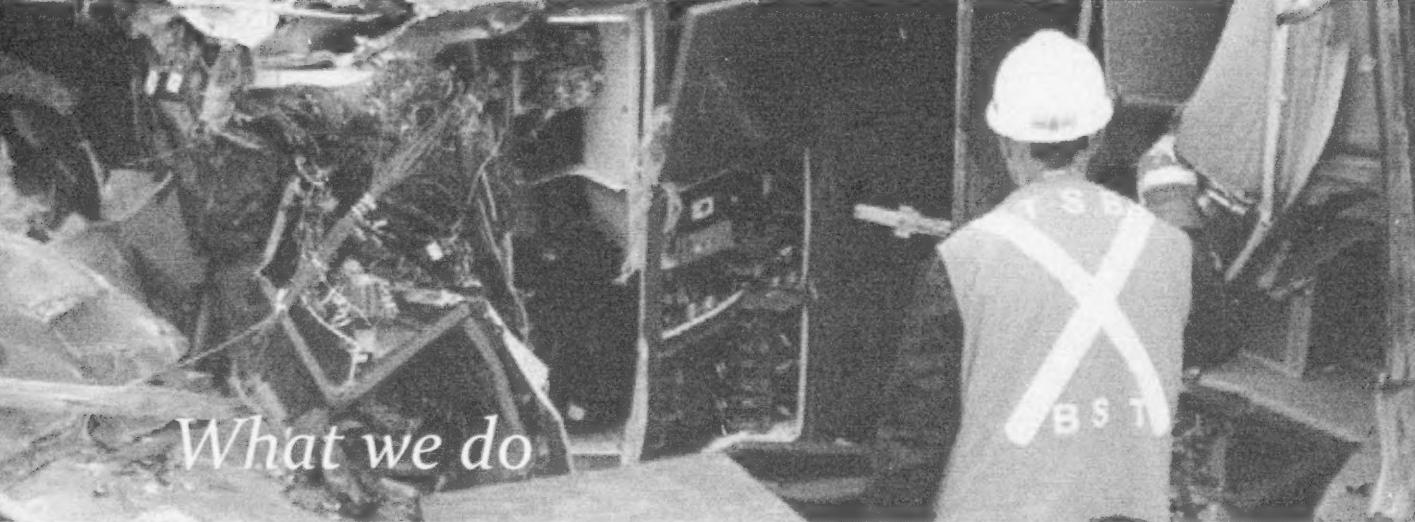
that it can withstand the highest scrutiny, and the safety lessons will live on.

This year, our Annual Report to Parliament again identifies progress in a number of key areas — 7 recommendations have received our highest rating of Fully Satisfactory. Flights into Canada's smaller airports, for example, have been made safer—as have cargo vessels on our Great Lakes. And on Canada's railways, the TSB is encouraged by indications from Transport Canada that important safety action is in the works. We have also taken significant steps to improve our databases and modernize the regulations that govern the reporting and investigation of occurrences, making them clearer and easier to understand.

This Annual Report marks my last as Chair of the TSB, and as I come to the end of my tenure, I am proud that our work here has made a real difference. Canada's transportation system is safer today than it was 12 months ago, just as it is safer than when I first joined the Board. However, much work remains, and it will be up to the regulators and industry to make sure they implement the changes we all need. Because a safe transportation network is critical to the health and prosperity of all Canadians—no matter where they live.

Wendy A. Tadros, Chair





## What we do

### Mission

The TSB's mission is to conduct independent safety investigations and communicate risks in the transportation system.

### Mandate

The *Canadian Transportation Accident Investigation and Safety Board Act* provides the legal framework that governs TSB activities. Our mandate is to advance transportation safety in the marine, pipeline, rail and air modes of transportation by:

- conducting independent investigations, including public inquiries when necessary, into selected transportation occurrences in order to make findings as to their causes and contributing factors;
- identifying safety deficiencies, as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- reporting publicly on our investigations and their findings.

As part of its ongoing investigations, the TSB also reviews developments in transportation safety and identifies safety risks that it believes government and the transportation industry should address to reduce injury and loss.

In making its findings as to the causes and contributing factors of a transportation occurrence, it is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board does not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings. No finding of the Board should be construed as assigning fault or determining civil or criminal liability. Findings of the Board are not binding on the parties to any legal, disciplinary, or other proceedings.

### Independence

When an accident occurs, it's the TSB's role to find out what happened and why. Delivering these results for Canadians also means earning their trust and confidence in the work that we do, which is why our organization must be objective.

independent, and free from any conflict of interest. By currently reporting to Parliament through the Leader of the Government in the House of Commons, the TSB remains separate from all other government departments

and agencies. Our independence helps ensure we can arrive at impartial conclusions and make recommendations to those best placed to take action.



## Who we are

The TSB consists of approximately 220 employees located across the country. The Board itself is composed of up to five Board Members, including the Chair. Our headquarters is located in Gatineau, Quebec. We have a laboratory in Ottawa, and regional offices in Vancouver, Edmonton, Calgary, Winnipeg, Toronto, Montréal, Quebec City, and Halifax.

TSB employees come with a wide range of background careers, including airline pilots, rail and pipeline experts, computer technicians, journalists, lawyers, engineers, vessel masters, fishermen, accountants, and former members of the Canadian Forces, to name just a few. Whether they are meticulously recreating flights in a simulator based on recorder

information, evaluating failure mechanisms and documenting damage sustained to tank cars, examining historical occurrence data, or disassembling a hydraulic lever to determine why it didn't close the shutter door to a holding tank, these men and women have spent over two decades making the TSB a world leader in transportation safety.

## Our values

**As federal public service employees, we are guided by the enduring public service values—respect for democracy, respect for people, integrity, stewardship and excellence. We at the TSB also place a particular emphasis on our own core values, which are of the utmost importance to the successful achievement of our mandate.**

### Excellence

We maintain a highly skilled and knowledgeable team of professionals through leadership, innovation and commitment to continuous improvement in the delivery of our products and services.

### Openness

We actively promote the exchange of information to advance transportation safety.

### Integrity

We are guided by honesty, impartiality, propriety, and accountability for our actions and decisions.

### Respect

We are committed to treating all individuals and organizations with consideration, courtesy, discretion and fairness.

### Safety

We maintain and promote a positive and proactive safety culture.



**Jacqueline Roy**

Director, Communications

**Marc-André Poisson**

Director, Marine Investigations

**Allen Harding**  
General Counsel

**Jean L. Laporte**

Chief Operating Officer

**Mark Clitsome**

Director, Air Investigations

**Chantal Lemire**

Director General, Corporate Services

**Leo Donati**  
Director, Operational Services

**Kirby Jang**

Director, Rail/Pipeline Investigations

## Leading the change

In 2013–2014, the TSB continued to implement the objectives set by senior management in the 2011–2012 to 2015–2016 Strategic Plan. Significant progress was made in such key areas as data management, increasing awareness of the TSB and its work, and maintaining a knowledgeable and professional workforce. More specifically, we developed and delivered training in interviewing for TSB investigators, expanded our communications activities to broader audiences, completed modernization of the marine modal database system, and made progress on modernization of the air modal database system.

These modernized systems will enhance our capability to further analyze data on a consistent basis and to eventually share the data sets publicly.

The TSB's senior management team fully implemented the budget reductions announced in Budget 2012. Specific functions were restructured and selected positions were eliminated. The business process for 24 hour response was reviewed and streamlined. Important savings were achieved in training, travel and contracting. A review of key business processes to streamline operations was initiated and is progressing well.

2013–2014 was a pivotal year for the TSB, one that proved to be demanding and challenging, yet markedly productive in the advancement of transportation safety in Canada. The TSB faced competing priorities and a surge in the number of significant accidents, and yet, under the strategic direction of our senior management team, we continued to deliver high-quality investigations and uphold the credibility of the TSB in the eyes of industry, regulators and Canadians.

# Employee recognition

The hours are long enough as it is, but some of us put in a few more than others. They're the ones who go the extra mile to make sure everything is exactly as it needs to be, or even better. They're the ones who always make the deadline, or even beat it. They're the ones you want on your team—and the ones we're glad are on ours. To the doers, the helpers, and the leaders who inspire us with their passion and their effort, this is our chance to say thank you.



## Transportation Safety Board Awards

Each year, the TSB honours the hard work and accomplishments of our outstanding employees during National Public Service Week. In 2013, six special individuals were recognized by their peers for making lasting and inspiring contributions to the public service. These recipients have not only gone out of their way to help colleagues, but also provided invaluable leadership on critical TSB projects.

**Outstanding Achievement Award:** This award was given to Paulo Ekkebus, a Senior Investigator in the Marine Branch, for his leadership role in the development of the new Marine Safety Information System (more commonly known as MARSIS), an initiative that saw the complete redesign and successful streamlining of the system that greatly improved its functionality.

**Excellence in Leadership Award:** This award was presented to Peter Hildebrand, the Manager of Regional Operations for the Air Branch in Winnipeg. Peter

was recognized for his exemplary reports, his ability to motivate his investigators to produce high-level products, and his professionalism while co-operating with other departments.

**The Impact Award:** This award was given to Strategic Communications Advisor Murray Jones for his outstanding work in developing and implementing the TSB's social media presence.

**The Client Service Award:** This award was presented to two employees, Michael Doré and Marc Lalande, for their exceptional work and commitment to providing high-quality client service within the TSB.

**The Excellence in Investigation Award:** This award was given to the Exact Air investigation team, under the leadership of Pierre Gavillet, for their excellence in the Beech King Air 100 accident investigation. Their findings were subsequently used as the basis for safety recommendations and as a model for transportation safety messages throughout Canada.

# The transportation safety landscape

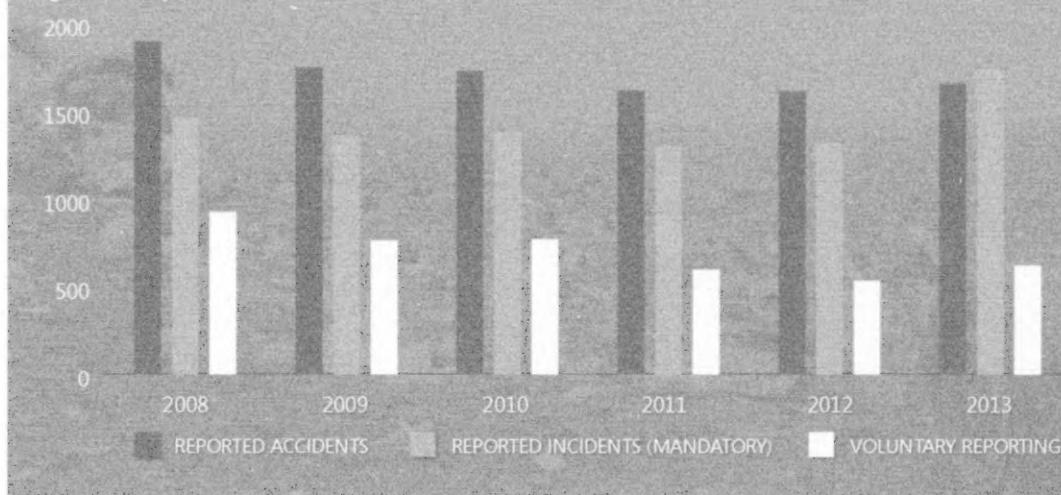
In 2013, a total of 1658 accidents and 1737 incidents were reported in accordance with the TSB's regulations for mandatory reporting of occurrences.<sup>1</sup> The number of accidents in 2013 increased by 3% from the 1613 accidents reported in 2012, but decreased by 4% from the 2008–2012 annual average of 1721 accidents. The number of reported incidents increased to 1737 in 2013 from 1318 in 2012, and from the 2008–2013 average of 1364. In 2013, the TSB also received 618 voluntary reports.<sup>2</sup> Fatalities totalled 209 in 2013, up 49 from the 2012 total, and up from the 2008–2012 average of 162.

## Reported occurrences

All reported occurrences were assessed under the Board's Occurrence Classification Policy to identify those with the greatest potential for advancing transportation safety. It is in these cases that a formal investigation is launched. However, whether we investigate or not, all information is entered into the TSB's database to keep records, analyze trends, and validate safety issues.

In fiscal year 2013–2014, investigations were undertaken for 49 of the occurrences reported to the TSB. In that same period, 69 investigations were completed, compared to 50 in the previous year.<sup>3</sup> The number of investigations in process decreased to 66 at the end of the fiscal year from 85 at the start. The average time to complete an investigation increased to 563 days in fiscal year 2013–2014 compared to the previous 5-year average (490).

**Figure 1: Reported occurrences**



1 While the Board's operations are for the 2013–2014 fiscal year, occurrence statistics are for the 2013 calendar year unless otherwise indicated. Please note that, in a live database, the occurrence data are constantly being updated. Consequently, the statistics can change slightly over time. Comparisons are generally to the last 5 or 10 years. For definitions of terms such as *accident*, *incident* and *occurrence*, see Appendix B.

2 "Voluntary reports" refer to all occurrences reported to the TSB that are not required to be reported under the *Canadian Transportation Accident Investigation and Safety Board Act*.

3 Investigations are considered complete after the final report has been issued. See Appendix A for a list of reports released by the TSB in 2013–2014 by sector.

## Investigations

Overall, the TSB has been very successful in identifying safety issues and contributing to a reduction in the risks in the transportation system. Each investigation led to a comprehensive report, identifying critical safety issues and contributing factors, communicating lessons learned and, when necessary, making recommendations aimed at reducing risks. Through the Occurrence Classification Policy and investigation methodology, our systematic approach ensured that TSB resources were invested in areas with the greatest safety payoffs.

**Figure 2: Investigations**



## Safety communications

In 2013–2014, in addition to investigation reports, the TSB issued a total of 71 safety communications,<sup>4</sup> including 10 recommendations, 25 safety advisories, 31 safety information letters, and 5 safety concerns.

**Table 1: Safety communications**

Sector	Recommendations	Safety advisories	Safety information letters	Safety concerns
Marine	0	6	7	2
Pipeline	0	1	0	0
Rail	6	17	24	2
Aviation	4	1	0	1
<b>TOTAL</b>	<b>10</b>	<b>25</b>	<b>31</b>	<b>5</b>

When the TSB identifies safety issues, it doesn't wait until the end of an investigation to alert industry and government. Safety information is also provided informally to stakeholders throughout the investigation process, allowing them to take immediate action—a common practice for industry and government. For example, within two weeks of the Lac-Mégantic accident, the TSB issued two safety letters calling for action to ensure trains are properly secured when left unattended. Since then, the TSB has issued two other safety letters and three recommendations, and the investigation is not yet completed.

<sup>4</sup> See Appendix B for the definition of each of the TSB's safety communications.

Discussions with TSB investigators can also lead operators to take important safety measures before a report is released. For example, TSB held briefings with officials from the City of Ottawa, OC Transpo, VIA Rail, and Transport Canada (TC) to inform them of some issues at the crossing where a bus-train collision took place. Immediate action was taken to clear sightlines at that railway crossing by trimming bushes and vegetation, and to re-align the signal lights and immediately inspect all crossing lights across that rail system.

Regulators such as TC and the U.S. Federal Aviation Administration regularly issue mandatory directives requiring inspections and replacements based on the TSB's preliminary findings. In these situations, the TSB reports on the corrective actions already taken by industry and government. When an investigation identifies a serious or systemic safety issue, the Board will issue a recommendation, which warrants the highest levels of regulatory attention.

*Under the Canadian Transportation*

*Accident Investigation and Safety Board Act*, a federal minister who is notified of a TSB recommendation must, within 90 days, advise the Board in writing of any action taken or proposed to be taken, or of the reasons for not taking action. The Board considers each response, assessing the extent to which the safety deficiency was addressed and provides its rating of the response and its reasoning soon after. The TSB continues to publish its yearly re-assessments of industry and government responses to its recommendations.

## Board assessments of responses to recommendations

Since 1990, the Board has reviewed the responses to a total of 553 recommendations. Many of these recommendations have led to positive change. As of 31 March 2014, Board recommendations that achieved Fully Satisfactory status remain at 74%. Another 7% were assessed as Satisfactory Intent, indicating that change agents have taken action or plan to take action that will substantially reduce the safety deficiency.

In 14% of cases, a rating of Satisfactory in Part was issued, which means change agents have taken or plan to take action that will only partially address the deficiency. The remaining 4% of responses received a rating of Unsatisfactory, as change agents have not, and do not plan to, take action that will address the deficiency. The Board has been unable to assess the responses to 2 recommendations and has not yet assessed 4 pending

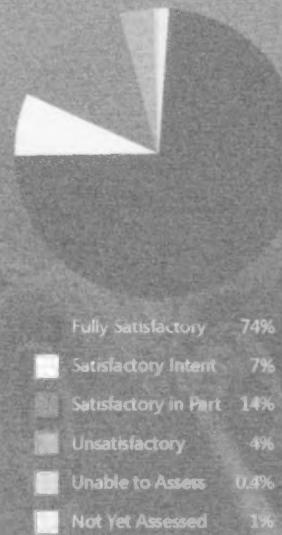
responses to recently issued recommendations.

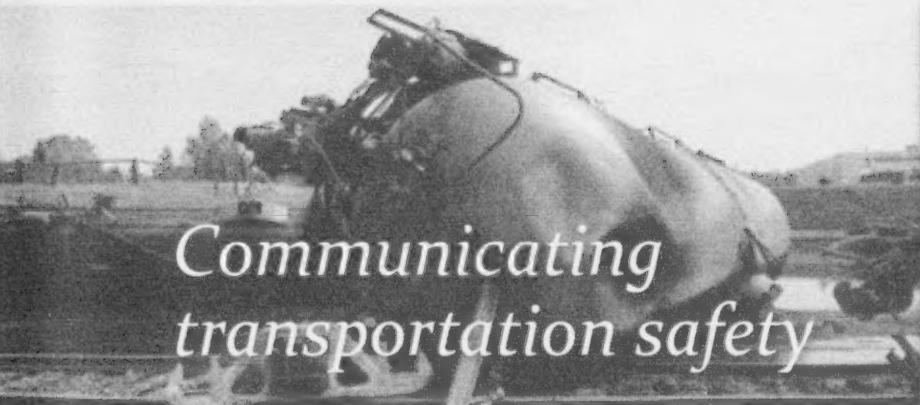
To continue to raise the bar on safety, the Board is aiming for 80% of its recommendations to become Fully Satisfactory by March 2017. While some positive change has taken place, the Board remains concerned that not enough has been done to address outstanding safety issues, most strikingly in aviation.

**Table 2: Board assessments of responses to recommendations, 1990–2014**

	Marine	Pipeline	Rail	Air	Recommendations	%
Number of recommendations	147	20	137	253	557	100
Fully Satisfactory	121	20	118	155	414	74
Satisfactory Intent	15	0	5	19	39	7
Satisfactory in Part	9	0	10	58	77	14
Unsatisfactory	2	0	1	18	21	4
Unable to Assess	0	0	0	2	2	0.4
Not Yet Assessed	0	0	3	1	4	1

**Figure 3: Ratings of assessed responses, 1990–2014**





# Communicating transportation safety

*"A shout out to @TSBCanada Twitter account for actually offering useful info and photos. Sets a good standard for govt."*

Rosemary Barton (@RosieBarton),  
CBC National reporter on Parliament Hill

## Reaching out to Canadians

At the Transportation Safety Board of Canada, we do a lot more than conduct investigations. Our mandate requires that we publicly report on those investigations, which means making sure the people who need to receive information—industry, regulators, and the Canadian public—have easy access to it.

Meeting this part of our mission involves more than translating our reports into both official languages—a lot more. Our website, for example, not only serves as a handy means to access our reports, recommendation, and news release, but it also contains the many animations and videos that we produce. In addition, it's a key source for those seeking statistics on incidents and accidents—broken down and sorted by mode, region, year and month.

We're also busy on social media, and as more and more Canadians demand updates quickly, we are constantly sending out a steady stream of tweets on topics that matter: deployment notices, safety alerts, investigation reports, and

key safety messages. Cyberspace has taken notice too, and over the past year, we've passed some major social media milestones: almost 7,000 followers on Twitter, over 200,000 video views on YouTube, and more than 1.5 million photo views on Flickr.

Some communications though are best done face to face. That's why we've developed an active outreach program, to meet face to face with stakeholders in every region of the nation. Our investigators and Board members attend well over 100 events a year, sharing their knowledge and insights, and updating Canadians on the kinds of change we want to see.

A similar rationale is behind another of our newer tools: the TSB's blog: *The TSB Recorder*. Not only does each post highlight a key safety issue, but the stories we share also serve to give Canadians a glimpse of the people behind the scenes. It's an opportunity to show off not just our work, but the tremendous amount of pride that the men and women who work here take in their jobs.

And then, of course, there's our media relations division—the people most often on the "front lines" of communication. They're the ones who answer calls from reporters, newspaper editors and sometimes members of the public, 24 hours a day! Last year alone, we handled over 1,300 media enquiries, in addition to giving 566 interviews and issuing 91 news releases.

So regardless of whether you're turning the pages of a "hard copy" of a TSB booklet, logging into our website, or browsing our latest tweets on your smartphone, we're reaching out to you, and all Canadians, in as many ways as possible. That's because, when it comes to communicating, there's no such thing as "one size fits all." From coast to coast to coast, Canadians' media preferences are as different as the languages they speak and the cities and towns they live in. Recognizing that difference, and catering to it, is a challenge we happily accept.

## Watchlist

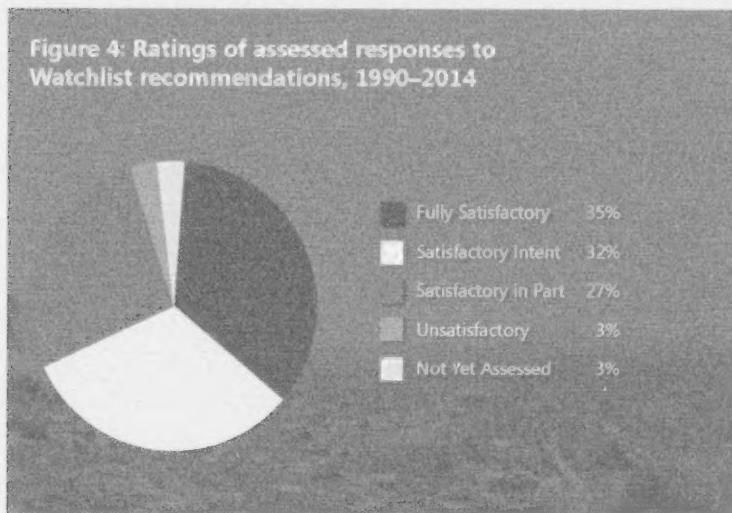
In the spring of 2012, the Transportation Safety Board of Canada updated its Watchlist, which was first introduced in 2010. This is the list of safety issues that the Board believes pose the greatest risk to Canadians.

Every two years or so, we review these issues and determine whether enough progress has been made to remove them from the list. We also examine other safety issues to identify any trends and decide whether to add new concerns to our list. For example, 2 Aviation recommendations related to the issue of landing accidents and runway overruns were rated Fully Satisfactory in 2013-2014, and another was recently introduced. In Rail, meanwhile, 2 additional recommendations have given further support to the issue of on-board voice-and-video recorders, and following signal indications, respectively.

With 13 of the Board recommendations receiving the TSB's highest rating, Fully Satisfactory recommendations associated with Watchlist 2012 went from 32% in 2012-2013 to 35% in 2013-2014. Satisfactory Intent recommendations related to the Watchlist went from 44% in 2012-2013 to 32%, and Satisfactory in Part recommendations increased to 27% in 2013-2014 from 21% in 2012-2013 (this includes the additional two rail recommendations that were added to Watchlist items in 2013-2014). Meanwhile 3% of recommendations remain Unsatisfactory in 2013-2014, unchanged from 2012-2013 and 1 aviation recommendation in 2013-2014 has a rating of Not yet assessed.

This is a summary of some successes and some of the issues that persist on the Watchlist and where more needs to be done.

**Figure 4: Ratings of assessed responses to Watchlist recommendations, 1990–2014**



## Marine

The marine Watchlist issues have prompted ongoing dialogue and raised awareness of fishing vessel safety. However, less progress has been made with respect to small commercial vessels and safety management systems.

**Loss of life on fishing vessels**  
Several marine investigations were completed in 2013–2014, allowing the TSB to take stock of the marine community's progress in improving fishing vessel safety. It is clear that efforts are being made throughout Canada to instill a strong safety culture. However, the number of fishing-related fatalities has remained constant—15 in 2013. Mariners need to gain a better understanding of the risks at hand, something that will happen only when safety is better integrated into all fishing operations. To do so, federal and provincial governments, and leaders in the fishing community need to establish regional governance structures aimed at ensuring that fishermen can and will work safely.

The Board is also hopeful that the new TC *Fishing Vessel Safety Regulations* will be implemented this year, thereby addressing TSB recommendations on anti-exposure work suits or survival suits, the stowage and launching of life rafts, the carriage of emergency position-indicating radio beacons (EPIRBs), and vessel stability issues.

### Marine safety management systems

Marine safety management systems (SMS) continue to be a top priority for the TSB, in particular, the introduction of safety management systems for commercial operators of small passenger vessels. No progress has been made on this recommendation (Mo4-01), which dates back to 2004. But it is not just small passenger vessels that can benefit from an SMS. The Board will continue to push for concrete action until a tailored solution to implement effective safety management principles is in place for all commercial vessels operating in Canadian waters.

## Rail

The Watchlist has brought the most pressing rail issues to the forefront. However, only 3 of 11 (27%) associated recommendations are Fully Satisfactory.

### On-board video and voice recorders

Objective data is required to accurately piece together the sequence of events leading to an accident and to identify operational issues and human factors. Locomotive Voice and Video Recorders (LVVR) allow investigators to confirm the nature of crew communications and the dynamics of crew interactions. A number of TSB rail investigations have identified human factors as an underlying condition or an unsafe act. Many of these investigations would have benefitted from a recording of crew communications immediately prior to the accident. Presently, the Board is concerned that there is no requirement for on-board video and voice recorders on locomotives. The rail industry should ensure that communications in locomotive cabs are recorded.

### Following signal indications

If signals are not consistently recognized and followed, collisions and derailments can occur, resulting in significant risk to the public and the environment. Centralized Traffic Control (CTC) provides train crews with a series of signals that convey information such as operating speed and operating limits. However, CTC does not

provide any warning that a train may be passing beyond a restricted location, nor does it provide automatic means to slow or stop a train. The current defences are not adequate in situations where the train crew misinterprets or misperceives a signal indication, or when a crew does not apply, or misapplies, an operating rule. The Board continues to believe that further safety defences should be implemented to ensure that signal indications are consistently recognized and followed.

### Passenger trains colliding with vehicles

About every two weeks, a passenger train collides with a vehicle at a public railway crossing. Warning signs serve as the first line of defence, by making drivers aware of the crossing. In addition, approximately one-third of public crossings in Canada have crossing gates and/or flashing lights and bells. Despite these devices, however, the risk of passenger trains colliding with vehicles remains too high in busy rail corridors. TC must implement the new grade-crossing regulations, develop enhanced standards for certain types of crossing signs, and continue its leadership role in crossing safety assessments. The Board believes that comprehensive solutions must also include further public awareness of the dangers at railway crossings.



## Aviation



With the rating of Fully Satisfactory for 2 Aviation recommendations in 2013–2014 (A12-01 and A12-02),<sup>3</sup> 3 of the 8 Watchlist-related Aviation recommendations are now Fully Satisfactory in 2013–2014. The others, which deal with safety management systems, landing accidents and runway overruns, risk of collisions on runways, and collisions with land and water, remain of concern to the Board.

**Collisions with land and water**  
A collision with land and water happens when an otherwise sound aircraft, under pilot control, is unintentionally flown into the ground, a mountain, water, or an obstacle. Referred to by industry as a “controlled flight into terrain,” from 2009 to 2013 these collisions represent just 3% of aviation accidents, but almost 18% of all fatalities. In 2013–2014, TC published terrain awareness warning system (TAWS) regulations and clarified the requirements for TAWS systems that are equipped with enhanced altitude accuracy function. This change, once fully implemented, will address a long-standing Board recommendation (A95-10), reducing controlled flight into terrain accidents in commercial operations.

**Safety management systems**  
Since 2005, large air carriers in Canada have been required to have safety management systems. This requirement doesn’t, however, extend to smaller carriers, such as air taxis, helicopter operators, commutes airlines, and flight training schools, which together are responsible for 94% of all commercial aviation accidents and

96% of all commercial aviation fatalities. The Board is concerned that, in the absence of TC requirements, the passengers and aircraft of these smaller operators are being placed at unnecessary risk.

**Risk of collisions on runways**  
The TSB has long been concerned about the risk of collisions on runways, which industry often refers to as “incursions.” Since this issue was first placed on the Watchlist, the numbers have not come down: TC’s CADORS database shows that in 2010, there were 346 incursions; in 2011, there were 454; in 2012, another 429; and in 2013, there were 381. Despite the Board’s heightened concern, TC has done little to encourage airports to improve procedures and adopt enhanced collision-warning systems, which would considerably reduce this risk.

**Landing accidents and runway overruns**  
To ensure that passengers and crews arrive safely, pilots carefully calculate a number of variables, including the distance needed to land. Without accurate and up-to-date information, they run the risk of overrunning the runway. Through numerous investigations, the TSB has highlighted the need for improved runway surface condition reporting and backup defenses designed to stop aircraft from overrunning the runway. As Canada now lags behind international standards, the Board will continue to call on TC and airports to better prevent landing accidents and runway overruns.

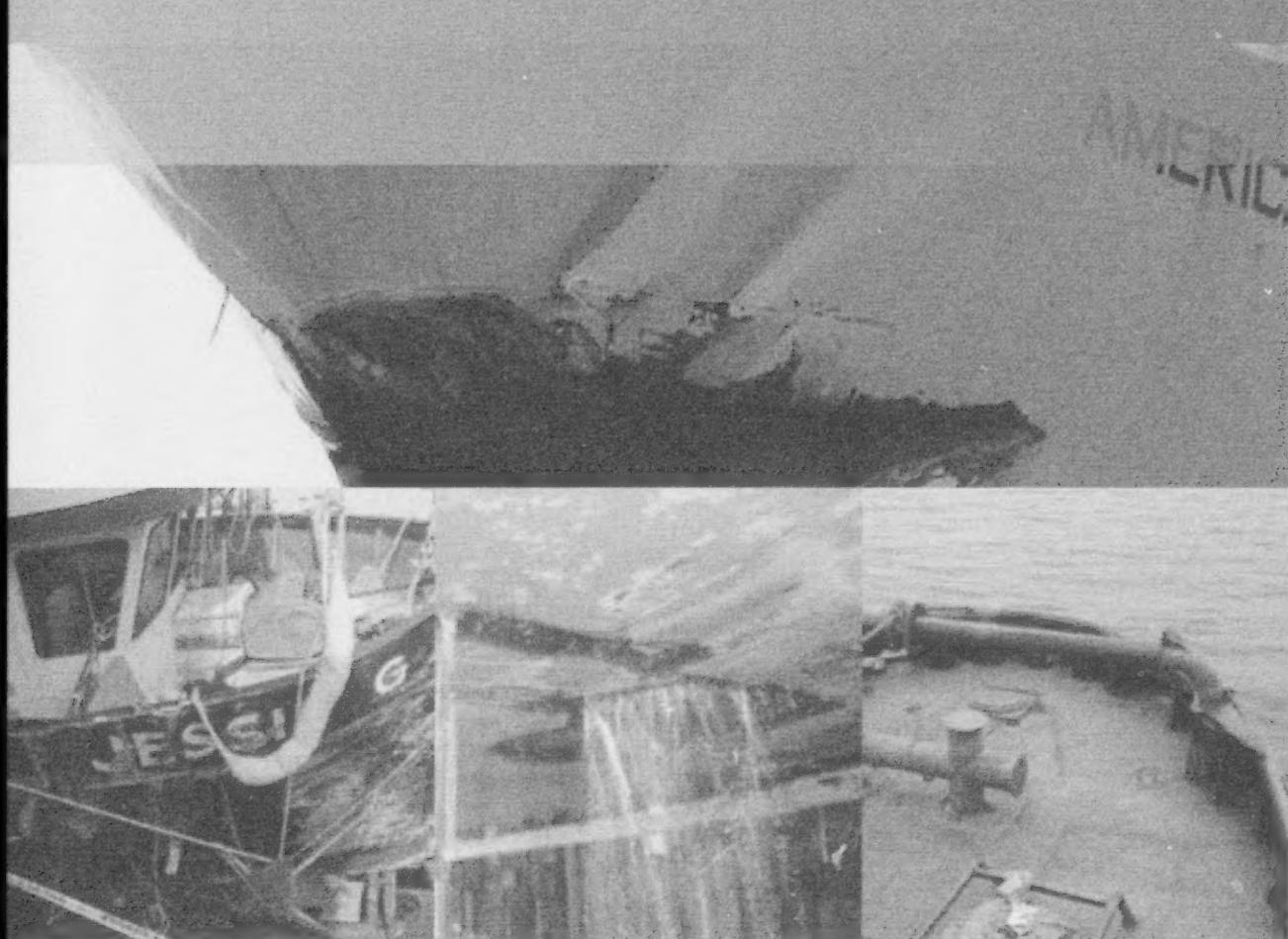


# Marine

Making safety a priority  
from coast to coast to coast



# Marine sector



## Annual statistics

In 2013, 305 marine accidents were reported to the TSB, up from the 2012 total of 288, but down from the 2008–2012 average of 357. Over the past 10 years, 87% of marine accidents were shipping accidents, while the remainder were accidents aboard ship.

There were 250 shipping accidents in 2013, a 5% increase from the 2012 total of 237, but an 18% decrease from the 2008–2012 average of 305.

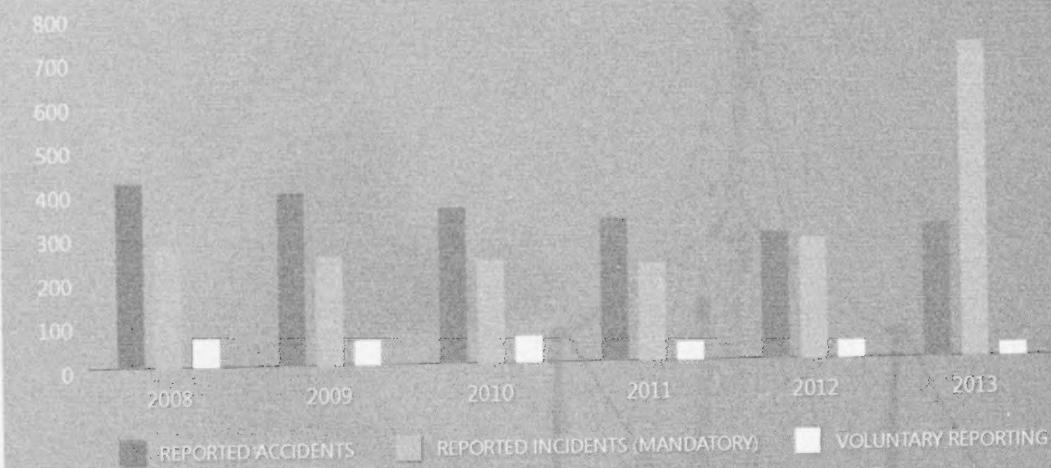
In 2013, there were 55 accidents aboard ship, up from 51 in 2012 and from the 2008–2012 average of 52.

The majority of accidents aboard ship occurred on fishing vessels (44%) and cargo, bulk carrier, or ore-bulk-oil (OBO) vessels (25%).

Marine fatalities totalled 19 in 2013, up from a total of 14 in 2012, but equal to the annual average of 19 in 2008–2012. Fishing vessels accounted for all (11) of the shipping accident fatalities. In addition, accidents aboard fishing vessels led to 5 of the 8 accident-aboard-ship fatalities. In total, there were 16 fishing vessel fatalities in 2013, up from the annual average of 11 in 2008–2012.

In 2013, there were 716 marine incidents reported in accordance with the TSB mandatory reporting requirements, up from 274 in 2012 and up from the 5-year average of 250. The increase in the number of incidents in 2013 is related to clarification of the threshold used to classify engine/rudder/propeller incidents in order to obtain a better understanding of related safety issues. This change is consistent with the interpretation contained in the new TSB Regulations to be published in July 2014.

**Figure 5: Marine occurrences**



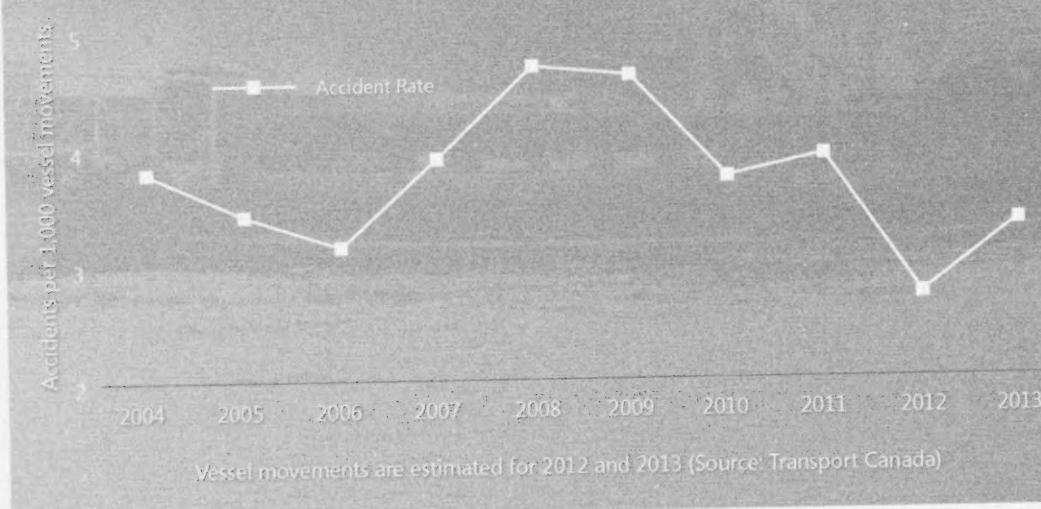
## Accident rate

One indicator of marine transportation safety in Canada is shipping accident rates for Canadian-flag commercial vessels (Figure 6). According to information provided by TC, marine activity for Canadian commercial

non-fishing vessels over 15 gross tons (GRT) (excluding passenger vessels and cruise ships) increased by 5% from the 2008–2012 average. The 2013 accident rate was 3.3 accidents per 1000 movements, down from the 5-year average of 1.6.

3.9. Marine activity for foreign commercial non-fishing vessels increased by 2% from the 2008–2012 average, while the accident rate decreased to 0.9 accidents per 1000 movements from the 5-year average of 1.6.

**Figure 6: Canadian-flag shipping accident rates**



## Investigations

In 2013–2014, 11 marine investigations were started, and 13 were completed. On average, investigations were completed within 458 days, a significant improvement from the 2012–2013 average of 522.

**Table 3: Marine Investigations at a glance**

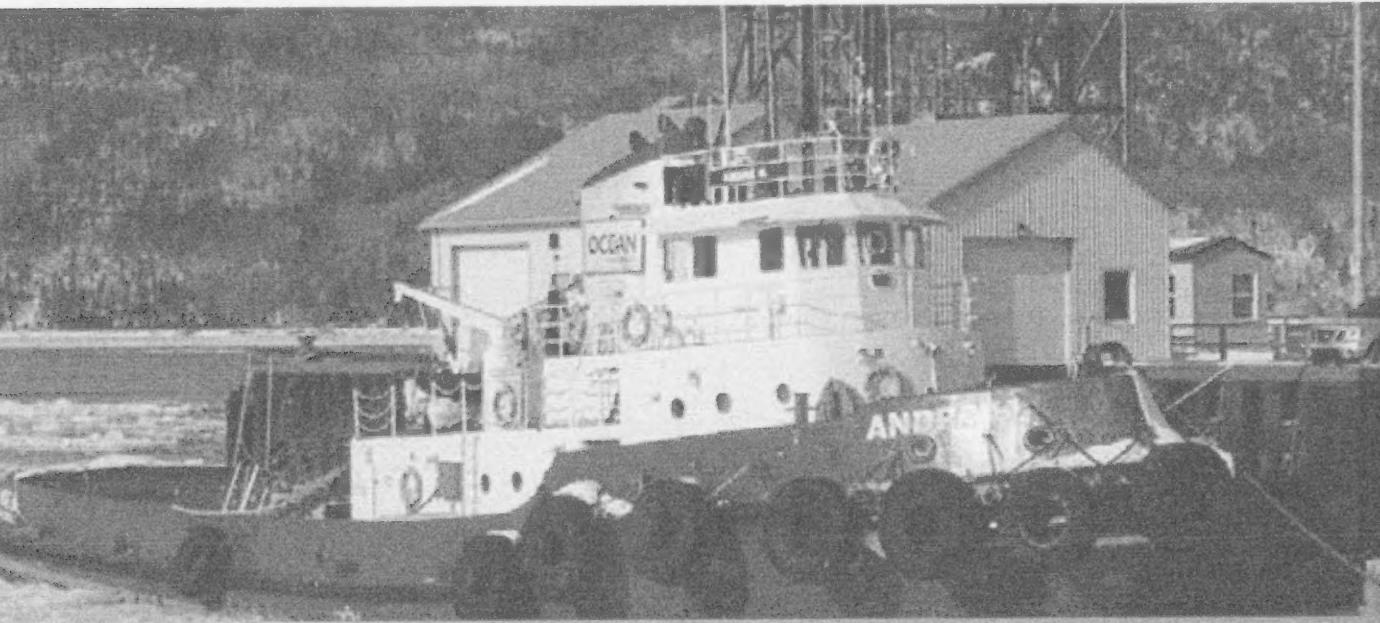
	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
Investigations started	6	12	6	9	12	11
Investigations completed	18	9	8	7	10	13
Average number of days to complete investigations	797	530	530	504	522	458
Recommendations	2	1	0	2	0	0
Safety advisories	7	7	5	8	5	6
Safety information letters	12	9	6	6	6	7

## Recommendations and progress

No marine safety recommendations were issued in 2013–2014. However, the Board reassessed responses to 10 active recommendations and 4 inactive recommendations. The 4 inactive recommendations were reviewed in order to determine what residual risks, if any, remained in the marine industry. Two of the inactive recommendations refer

to bridge resource management training for officers (M95-09 and M95-10), and the other 2 refer to fire protection in cargo tunnels of self-unloading vessels (M96-09 and M96-10). Following the reassessments of the active and inactive recommendations, the ratings were as follows: 2 Fully Satisfactory, 9 Satisfactory Intent,

2 Satisfactory in Part, and 1 Unsatisfactory. All other inactive recommendations will be reviewed over the coming year in order to determine whether they should be reassessed. While the results of these reassessments represent an improvement in the marine sector, key recommendations remain outstanding.





## Marine highlights

### Improvements to fishing safety still required

The comprehensive 3-year study on fishing safety in Canada<sup>5</sup> released by the TSB in early 2012 has kept safety issues at the forefront of the fishing industry in 2013–2014. Fishermen associations are reporting that fatalities in the industry are not as accepted as they once were, and that fishermen are improving their responses to emergency situations. Fishing safety associations on both the East Coast and West Coast have been working together to share ideas, and safety programs have been developing. In 2009, Fish SAFE in British Columbia initiated the 'Safest Catch' Program: a commercial fishing industry driven safety program, which

assists commercial fishermen in developing safety procedures and emergency drills. In the fall of 2013, the Nova Scotia's fishing community conducted a Safest Catch pilot program. Given the acceptance of the pilot project, the Nova Scotia fishing community and Fisheries and Oceans Canada's Atlantic Integrated Commercial Fishing Initiative vessels plan on full implementation of the program by Fall 2014.

TC's long-awaited new *Fishing Vessel Safety Regulations* are expected to expand safety requirements in areas such as distress-alerting capabilities, the wearing of lifesaving or personal protective gear, and the posting of stability notices on board the vessels to make it easier for crews to interpret stability data. These regulations were once again deferred by a year due to other TC priorities.

5. Transportation Safety Board (TSB), Marine Investigation Report No. M09Z0001, *Safety Issues Investigation into Fishing Safety in Canada* (2012). Available at [www.tsb.gc.ca/eng/reports-reports/marine/etudes-studies/m09z0001/m09z0001.pdf](http://www.tsb.gc.ca/eng/reports-reports/marine/etudes-studies/m09z0001/m09z0001.pdf)

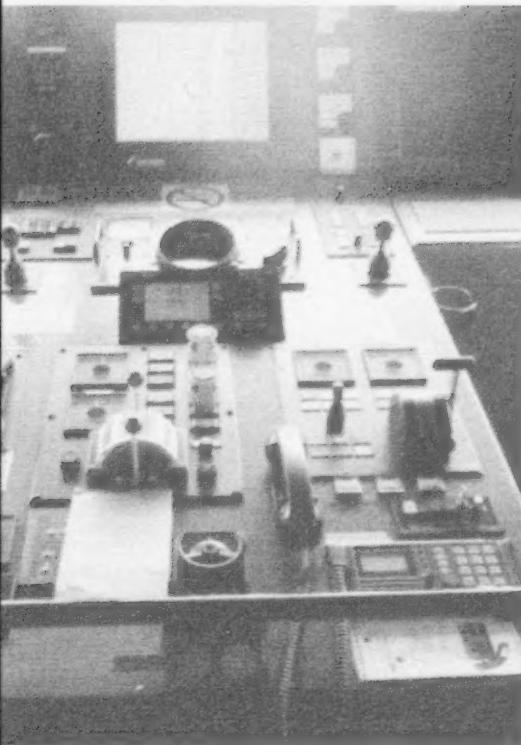
The regulations are now anticipated to be pre-published in the *Canada Gazette*, Part I during 2014.

The TSB, meanwhile, continued to meet with fishermen at association meetings and on the wharves. While recent initiatives are encouraging, further progress must be made, as demonstrated by the 15 fishing-related deaths in 2013. As fishermen continue to gain a better understanding of the risks to which they are exposed, they become more informed and are more likely to take the necessary action to prevent accidents.

"There's a reason these issues are on our Watchlist. And right now, the number of accidents involving loss of life on fishing vessels remains too high."

John Clarkson  
TSB Board Member





## Safety management systems

The broader adoption of safety management systems (SMS) in the marine industry continues to be a priority for the TSB. The goal of an SMS is to identify the risks associated with the operation of the vessel. Knowing what can go wrong allows for action to be taken to prevent it.

However, the adoption of SMS should not be limited to just the owners, operators and crews of vessels, but also to those providing services to the transportation industry. This need was demonstrated by an investigation

completed earlier this year on the West Coast, where the bulk carrier *Cape Apricot* struck a coal terminal while under the conduct of a pilot. Not only did the master and pilot lack a shared understanding of the approach, but there was no guidance for pilots to ensure that bridge resource management (BRM) best practices were in place throughout a voyage. The Board therefore concluded that, without an SMS in place, pilotage organizations may not properly identify hazards and mitigate them, thereby placing vessels at risk.

## The importance of effective teamwork

Effective teamwork, which is an integral part of BRM, helps to ensure a vessel's safe voyage. Everyone on the bridge must know their responsibilities, have a shared understanding of the vessel's intended voyage, and communicate about the vessel's progress throughout the voyage. In a recent TSB investigation (M12H0012), the importance of effective BRM was highlighted when the oil and chemical tanker *Nanny* grounded in a narrow waterway in the Arctic, after deviating from its charted course.

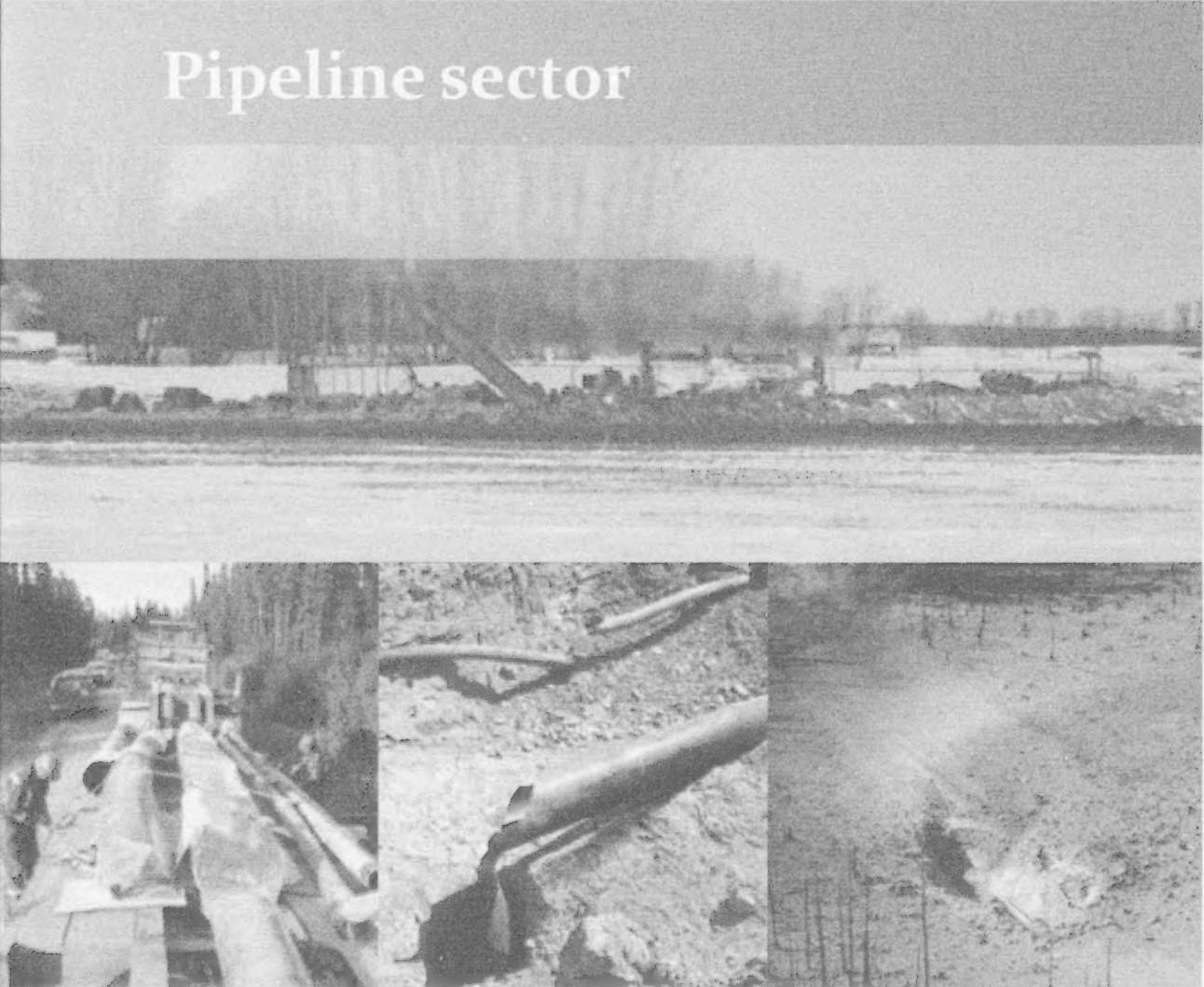
The investigation found that the route deviation was not discussed by the bridge team members, nor did they share navigational information during the passage. Combined with insufficient monitoring of the vessel's progress and ineffective BRM, the bridge team members were unaware of the extent to which the vessel was off the charted course as it entered the narrows—and they were therefore unable to take action to prevent the grounding.



Proven

Contributing to a strong  
safety record on federally-  
regulated pipelines for nearly  
a quarter century

# Pipeline sector



## Annual statistics

Eleven pipeline accidents were reported to the TSB in 2013, up from a total of 7 in 2012, and up from the annual average of 9 in the previous 5-year period (2008–2012).

The last fatal accident on a federally-regulated pipeline system occurred in 1988.

In 2013, 118 pipeline incidents were reported to the TSB, down from 173 in 2012, and down from the annual average of 137 in 2008–2012. This decrease is entirely accounted for by small releases (less than 1 cubic metre) at facilities, which decreased from 135 incidents (78% of all incidents) in 2012 to 76 incidents (64% of all incidents) in 2013.

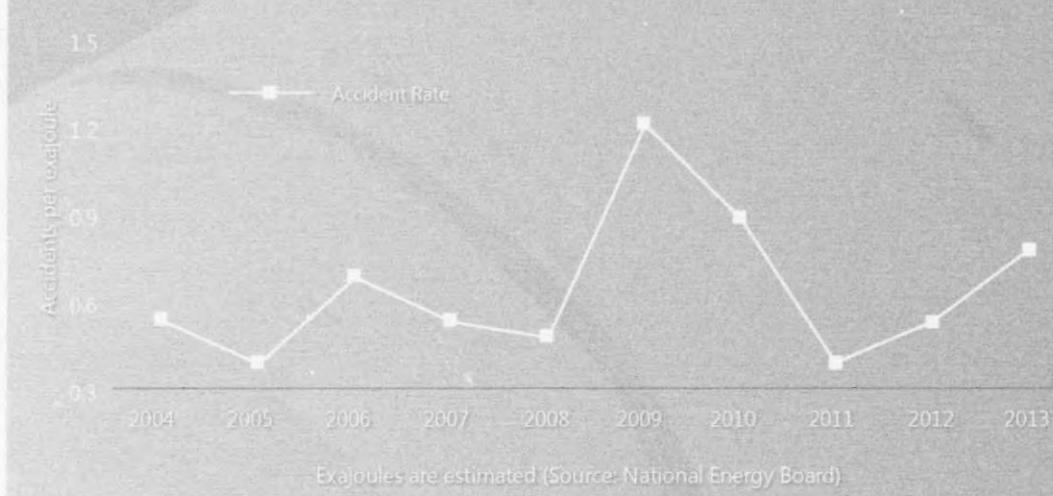
**Figure 7: Pipeline occurrences**



### Accident rate

One indicator of pipeline transportation safety in Canada is the pipeline accident rate (Figure 8). According to data provided by the National Energy Board, pipeline activity increased by 7% from 2012. The 2013 rate was 0.8 pipeline accidents per exajoule,<sup>6</sup> up from 0.5 in 2012, and up from the annual average of 0.7 in 2008–2012.

**Figure 8: Pipeline accident rate**



<sup>6</sup> One exajoule =  $10^{18}$  joules. A joule is a unit of work or energy equal to the work done by a force of 1 newton acting through a distance of 1 metre.

## Investigations

In 2013–2014, 2 pipeline investigations were started, and 2 investigations were completed. The average duration of completed investigations was 402 days, below the average of the previous 5 years (438 days).

**Table 4: Pipeline Investigations at a glance**

	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
Investigations started	1	3	1	0	3	2
Investigations completed	2	1	3	1	0	2
Average number of days to complete investigations	543	375	432	404	n/a	402
Recommendations	0	0	0	0	0	0
Safety advisories	0	0	2	1	0	1
Safety information letters	1	0	0	0	2	0

## Recommendations and progress

No pipeline safety recommendations were issued in 2013–2014. Because all of the TSB's pipeline recommendations have received the Board's highest rating of Fully Satisfactory, no responses to recommendations were reassessed.

## Pipeline highlights

### Hazard prevention programs for employee safety

Two maintenance employees sustained burns when sweet natural gas ignited in a valve-enclosure structure at Westcoast Energy Inc. (carrying on business as Spectra Energy Transmission) near Fort St. John, British Columbia (B.C.). Following a TSB Safety

Information Letter to the National Energy Board (NEB), Westcoast Energy was required to submit its hazard prevention program and a corrective action plan. As part of the safety action following TSB's investigation, released in September 2013, Westcoast Energy conducted

a natural-gas-leak survey at all facilities, while developing new processes and documentation. Updated standards in a revised hazard prevention program were developed to audit for safety deficiencies, including a mandatory gas monitor policy for employees.

### Control room management under review

Westcoast Energy's Nig Creek pipeline, northwest of Buick, B.C., ruptured and escaping gas exploded, triggering an adjacent

Bonavista Energy Corporation pipeline, located 3 m away, to also rupture and explode. TSB's investigation report, released in June 2013, determined that a pre-existing flaw in the Westcoast Energy pipe was the primary cause.

As part of the follow-up safety action, Westcoast Energy conducted the necessary integrity assessments

and repairs prior to seeking approval to return the pipeline into service. Testing on the entire Nig Creek pipeline was carried out at 125% of maximum operating pressure with no failures. Other safety action included a review of control room management and a review of emergency protocols for control room alarms.

"It's about safety, and making sure Canadians know they have a system they can trust."

Ian S. MacKay  
TSB Board Member





# Rail

Influencing changes that  
improve the safety of the  
Canadian railway system

# Rail sector



## Annual statistics

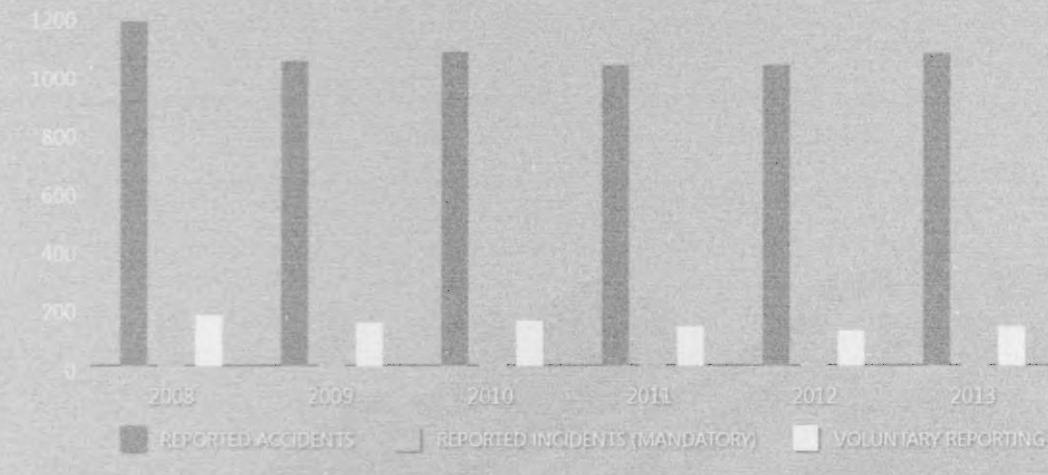
In 2013, 1067 rail accidents were reported to the TSB, a 4% increase from the 2012 total of 1027, but comparable to the 5-year average (2008–2012) of 1070.

Accidents involving dangerous goods totalled 144 in 2013, up from the 2012 total of 119 and up from the 5-year average of 133. Of these accidents, 7 resulted in a dangerous goods release in 2013, compared to the 2012 total of 2 and the 5-year average of 3.

Rail fatalities totalled 127 in 2013, up from the 83 recorded last year and up from the 5-year average of 76. Crossing fatalities totalled 31 in 2013, compared to 30 in 2012 and the 5-year average of 25. Trespasser fatalities totalled 44 in 2013, compared to 49 the previous year and 50 for the 5-year average. In 2013, "other fatalities" was the largest fatality category with 52, including 47 lives lost from the Lac-Mégantic accident (R13D0054). Five rail employees were fatally injured compared to 1 for the 5-year average.

In 2013, there were 218 reported rail incidents, down from the 235 recorded in 2012, but comparable to the 5-year average of 216. Movement exceeding the limit of authority (44%) continued to be the main incident type since 2006, followed by dangerous goods leakers (43%) and runaway rolling stock (5%).

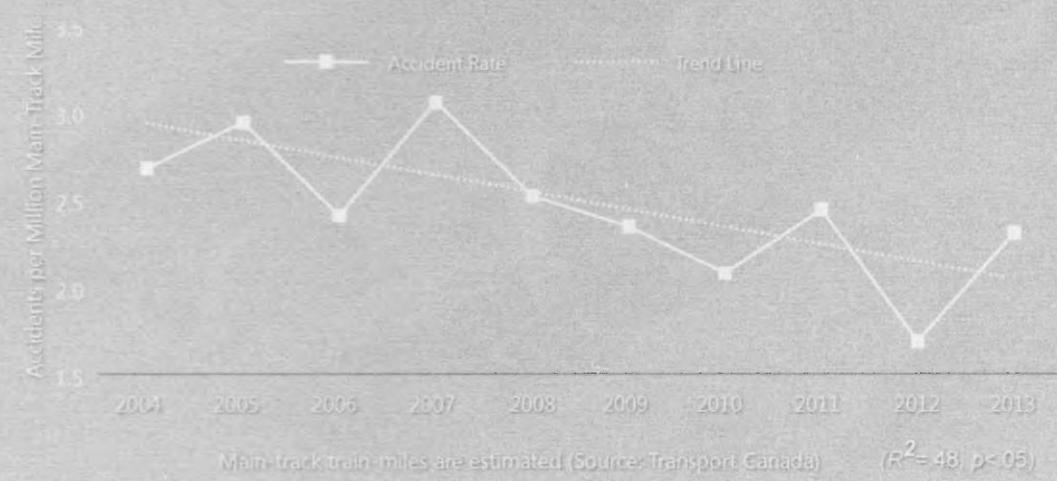
**Figure 9: Rail occurrences**



## Accident rate

One indicator of rail transportation safety in Canada is the main-track accident rate (Figure 10). According to data provided by TC, rail activity on main track decreased by 2% from the previous year. The main-track accident rate in 2013 was 2.3 accidents per million main-track train-miles, up 35% from 1.7 in 2012, but similar to the 5-year average of 2.2. However, there has been a downward trend in the accident rate over the past 10 years.

**Figure 10: Main-track accident rate**



## Investigations

A total of 16 rail investigations were started in 2013–2014, and 12 investigations were completed. The average duration of completed investigations was 435 days, up from the 2012–2013 average of 409 days and below the previous 5-year average (476 days).

Table 5: Rail Investigations at a glance

	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
Investigations started	14	18	14	17	12	16
Investigations completed	22	13	16	19	16	12
Average number of days to complete investigations	540	499	443	488	409	435
Recommendations	2	4	1	0	0	6
Safety advisories	11	8	9	9	4	17
Safety information letters	12	9	8	18	14	24

## Recommendations and progress

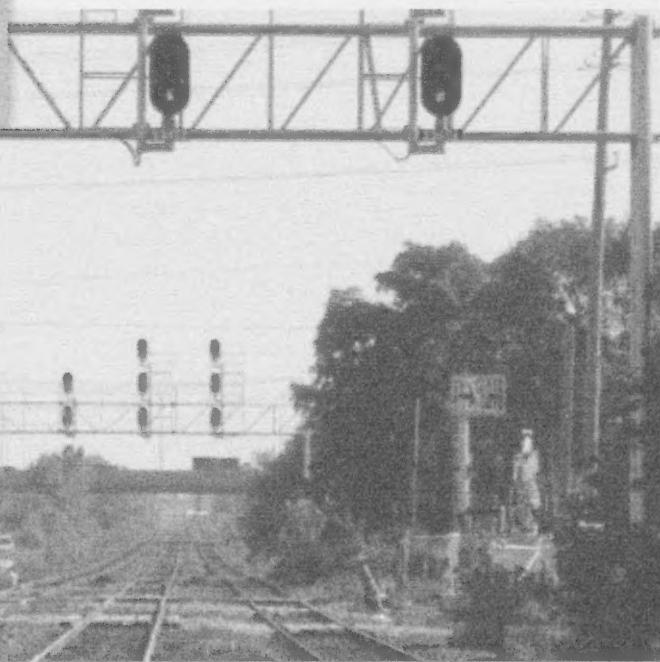
Six rail safety recommendations were issued in 2013–2014.

*No investigation speaks more profoundly to the TSB's purpose than the tragedy at Lac Megantic. We have dedicated ourselves to finding out what happened, and what needs to happen, to make all our communities safer.*

Wendy A. Tadros, Chair

The Board assessed 3 responses to new recommendations and reassessed responses to 10 active recommendations of the 137 issued since 1990. The Board's reassessments were communicated to change agents for information and action.

Of the 16 active rail recommendations, 7 were assessed as Satisfactory in Part (R07-04 and R09-01 have been upgraded), 5 were assessed as Satisfactory Intent (R96-05 was downgraded), 1 has been reassessed as Unsatisfactory (R91-01), and 3, issued on 23 January of this year, have not yet been assessed.



## **Recommendation R13-01**

On 26 February 2012, 3 locomotive engineers were fatally injured and dozens of passengers were injured when VIA 92 derailed at a crossover en route from Niagara Falls to Toronto. Investigators determined within days that the train had been travelling at more than 4 times

the allowable speed, and that the locomotive crew had not properly responded to signals requiring a slowdown to 15 mph.

The frequency of misperceived signals—approximately 1 per month in Canada—is a driving force behind the Board's

recommendation. Therefore, the Board recommended that:

*The Department of Transport require major Canadian passenger and freight railways to implement physical fail-safe train controls, beginning with Canada's high-speed rail corridors.*

### **Transport Canada response to Recommendation R13-01**

Transport Canada (TC) accepted the recommendation and formed a working group under the auspices of the Advisory Council on Railway Safety (ACRS) to focus on options with regard to train control systems.

The first meeting of the working group was held on 15 January 2014 to review the draft Terms of Reference for the project.

The working group held another meeting at the end of February

to discuss the scope of work—including a research component with TC's Railway Research Advisory Board (RRAB). This work will include an environmental scan of existing technologies.

### **Board assessment of Transport Canada response to Recommendation R13-01**

This recommendation is related to the TSB Watchlist issue of "Following signal indications," where there is a risk of serious train collision or derailment if railway signals are not consistently recognized and followed.

The working group has begun a process which may lead to positive safety action. However, the process may take significant time to produce any positive results. The TC response only undertakes to provide a work plan with timelines but gives

no projected date for future action. The risk of a serious train collision or derailment occurring in the absence of physical fail-safe train controls continues.

The Board therefore assessed TC's response as Satisfactory in Part.

## **Recommendation R13-02**

The dynamics and interaction between the 3 VIA crew members could not be accurately determined because there was no in-cab voice or video recording. Had this information been available, a more precise determination of causal factors could have been made allowing accident investigators to

more quickly identify key safety issues and eliminate extraneous factors that did not play a role in the accident. The absence of this valuable information left a number of questions unanswered and represents a lost opportunity to mitigate potentially serious crew resource management issues in the industry.

Therefore, the Board recommended that:

*The Department of Transport require that all controlling locomotives in main line operation be equipped with in-cab video cameras.*

### **Transport Canada response to Recommendation R13-02**

TC accepted the recommendation. Following this occurrence, TC referred the issue of locomotive voice recorders to the ACRS for consideration.

recorders on board locomotives, and to provide TC with options and recommendations as to how to address this issue.

The ACRS established a working group with representatives from the railways, the unions and TC to study the issue of both video and voice

recording devices on locomotives by railway companies.

At the same time, TC wrote to the Railway Association of Canada and individual railway companies to strongly encourage the voluntary installation of recording devices. TC is also encouraging the rail industry to use this technology in a non-punitive manner in the context of SMS programs.

### **Board assessment of Transport Canada response to Recommendation R13-02**

TC has accepted the TSB recommendation. However, TC supports the ACRS Working Group's recommendation to install voice/video recording devices on a voluntary basis only, and has written letters to individual

railway companies and the Railway Association of Canada urging the voluntary installation of recorders.

Furthermore, the Board is pleased that TC has committed to the use of voice and video recorders in a non-punitive manner in the context

of SMS programs. This will require legislative change, but at this time, there is no specific plan of action in this regard

The Board assessed TC's response as Satisfactory in Part.

### **Recommendation R13-03**

Currently over 90% of road locomotives operated by major Canadian railways were built prior to the establishment of the current, more comprehensive, crashworthiness standards. If these locomotives were to be rebuilt in Canada sometime in the future, under the current

Locomotive Safety Rules, none of them would be required to meet current crashworthiness standards. The absence of a regulatory requirement to upgrade locomotive crashworthiness during a major rebuild increases the risk that rebuilt locomotives will be susceptible to cab structural

failure, fuel tank failure and truck securement failure during derailments. Therefore, the Board recommended that:

*The Department of Transport require that crashworthiness standards for new locomotives also apply to rebuilt passenger and freight locomotives.*

### **Transport Canada response to Recommendation R13-03**

TC accepted the recommendation. The current *Railway Locomotive Inspection and Safety Rules* (revised on 4 February 2010) incorporate by reference the Association of American Railroads (AAR) *Manual of Standards and Recommended*

*Practices: Locomotive Crashworthiness Requirements*, Standard S-580.

TC Rail Safety solicited the Railway Association of Canada and its member railways to formulate rules

by March 2014 in order for the AAR crashworthiness standards to not only apply to new locomotives, but also to remanufactured passenger and freight locomotives. TC is waiting for the new rule submission.

### **Board assessment of Transport Canada response to Recommendation R13-03**

TC Rail Safety has solicited the Railway Association of Canada to formulate and submit rules that would apply AAR

crashworthiness standards to new and remanufactured locomotives. However, the outcome cannot be known until the process is finalized.

The Board assessed TC's response as Satisfactory Intent.

### **Recommendation R14-01**

On 6 July 2013, a Montreal, Maine & Atlantic Railway train ran uncontrolled on a descending grade and derailed 64 railway cars in the town of Lac-Mégantic, resulting in fire and explosions of railway tank cars carrying petroleum crude oil. Many buildings and vehicles, and the railway tracks, were destroyed. Forty-seven people died.

The TSB has been commenting on the vulnerability of Class III

cars for about 20 years. In previous investigations, the TSB identified the risks posed by the release of product from Class III tank cars and the vulnerability of these cars to release product due to accident damage. Design improvements are needed to mitigate the risks of a dangerous goods release and the consequences witnessed in the Lac-Mégantic accident. Given the magnitude of the risks and given that tank car standards must

be set for the North American rail industry, the Board therefore recommended that:

*The Department of Transport and the Pipeline and Hazardous Materials Safety Administration require that all Class III tank cars used to transport flammable liquids meet enhanced protection standards that significantly reduce the risk of product loss when these cars are involved in accidents.*

#### **Transport Canada response to Recommendation R14-01**

This recommendation was issued on 23 January 2014, and the Minister of Transport had 90 days to respond. Therefore,

as of 31 March 2014, the response to this recommendation was not yet assessed.

#### **Recommendation R14-02**

A primary safety concern related to the transportation of dangerous goods by rail is the prevention of a catastrophic release or explosion in a densely populated area or in an environmentally-sensitive area. The Lac-Mégantic accident has heightened the public's awareness of the risks associated with the transportation of dangerous goods.

The Association of American Railroads (AAR) Circular OT-55-N or similar operating restrictions are necessary to alleviate many of the shortcomings identified during the Lac-Mégantic investigation and other investigations involving the release of dangerous goods. However, these measures need

to be complemented by a more comprehensive, proactive approach. An approach based on Circular OT-55-N, strengthened with a requirement to conduct route planning and analysis, would be a positive step to improve the safety of transporting dangerous goods by rail. Therefore, the Board recommended that:

*The Department of Transport set stringent criteria for the operation of trains carrying dangerous goods, and require railway companies to conduct route planning and analysis as well as perform periodic risk assessments to ensure that risk control measures work.*

#### **Transport Canada response to Recommendation R14-02**

This recommendation was issued on 23 January 2014, and the Minister of Transport had 90 days to respond. Therefore,

as of 31 March 2014, the response to this recommendation was not yet assessed.

#### **Recommendation R14-03**

The transportation of large volumes of flammable liquids, such as petroleum crude oil, does not require an Emergency Response Assistance Plan (ERAP). However, approved ERAPs would consistently ensure that first responders have access, in a timely manner, to the required resources and assistance in an accident involving significant quantities of flammable hydrocarbons.

Given the significant increase in the quantities of crude oil being transported by rail in Canada, and the potential for a large spill with the risks it would pose to the public and the environment, the Board recommended that, at a minimum:

*The Department of Transport require emergency response assistance plans for the transportation of large volumes of liquid hydrocarbons.*

#### **Transport Canada response to Recommendation R14-03**

This recommendation was issued on 23 January 2014, and the Minister of Transport had 90 days to respond. Therefore,

as of 31 March 2014, the response to this recommendation was not yet assessed.



## Rail highlights

### Determining what really happened

Following a horrific 1986 collision between a passenger train and a freight train, "black boxes" or locomotive event recorders (LERs), were installed on all leading locomotives in Canada. The knowledge gained from these recorders has helped determine the causes and contributing factors in many rail accidents. Since then, the use of forward-facing video cameras has provided additional insight into the view from the locomotive cab. More information, however—

particularly with respect to the nature of crew communications and the dynamics of crew actions just prior to an accident—is still required.

This need was reinforced by the TSB's investigation into a fatal 2012 derailment of a passenger train near Burlington, Ontario. Without definitive information about crew actions prior to the accident—information that might have been provided by in-cab voice and video recordings—the Board was unable

to determine precisely why the crew did not follow the signals that were displayed. Not only did this occurrence leave unanswered questions, but it represents a lost opportunity to mitigate potentially serious crew resource management issues in the industry.

The Board, therefore, has placed the issue on its Watchlist and recommended that all controlling locomotives in main line operation be equipped with in-cab video cameras.

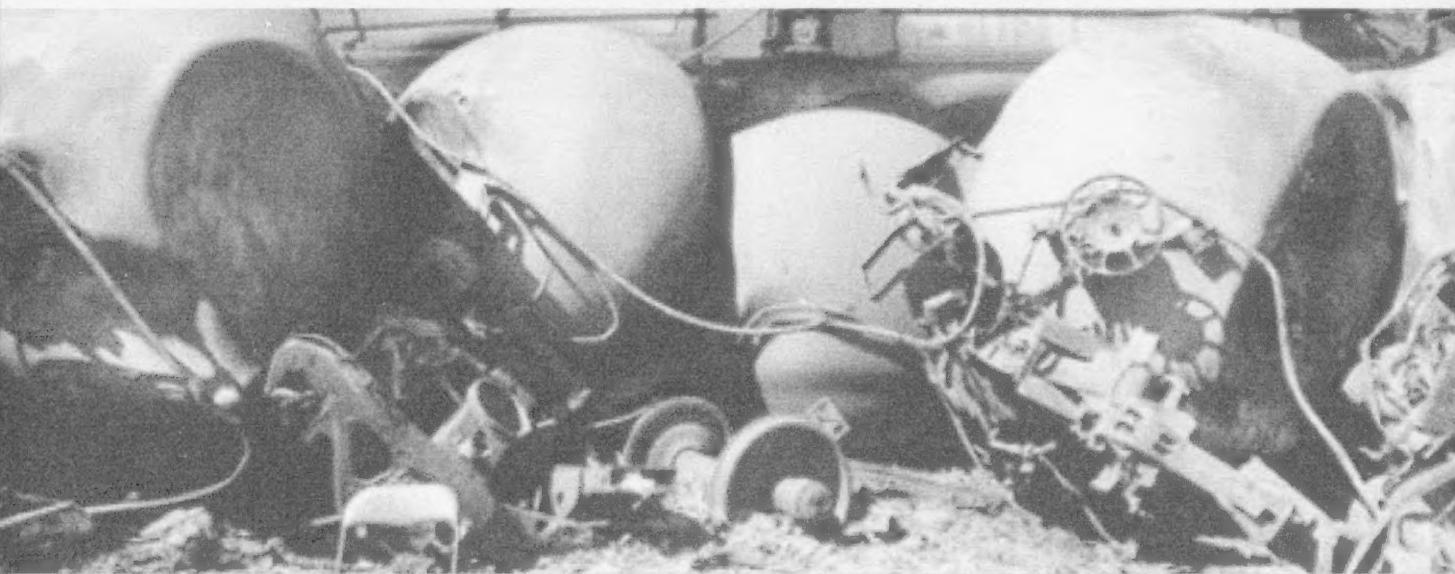
### Structural safety of tank cars

The TSB has long sought improvements in the safety and structural integrity of Class III tank cars used to transport dangerous goods across Canada—including gasoline, diesel fuel, and crude oil. In 2004, for example, a derailment near Saint-Henri-de-Lévis, Quebec, saw 18 tank cars spill some 200,000 litres of gasoline and diesel fuel. The damage sustained by these cars, was typical of that identified by previous TSB investigations when the tank shells and heads were breached.

The Class III tank car's weaknesses have been acknowledged by both the regulator and industry. However, it wasn't until 2013, when a train carrying petroleum crude oil derailed in Lac-Mégantic, Quebec, that the issue became a nationwide concern. Following the Lac-Mégantic accident, which killed 47 people and devastated an entire town, the Board again pushed hard for more stringent design improvements to these tank cars, as almost all of the 63 cars involved

were breached and released product.

What's needed are enhanced protection standards that significantly reduce the risk of product loss when these cars are involved in accidents. These standards could include stronger tank shells, tank car jackets, full-height head shields, thermal protection, and high-capacity pressure relief devices.





# Aviation

Pushing for change—and safer  
operations—for all Canadians



# Aviation sector



## Annual statistics

In 2013, a total of 275 aviation accidents were reported to the TSB, a 5% decrease from the 2012 total of 291 and a 4% decrease from the 5-year average of 285. Of the total, 242 involved Canadian-registered aircraft (excluding ultra-lights), similar to 2012 and unchanged from the 5-year average of 243.

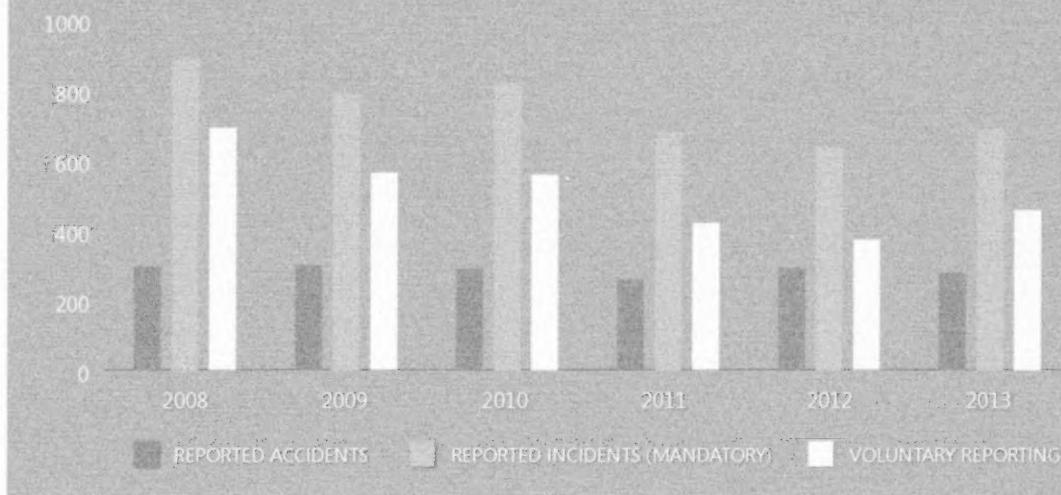
The 242 accidents involving Canadian-registered aircraft included 203 accidents involving aeroplanes (39 of which involved commercially-operated aeroplanes) and 27 accidents involving helicopters. The remaining 13 accidents involved gliders, gyroplanes, balloons, or unmanned aerial vehicles (UAV).

In 2013, 30 fatal accidents involved Canadian-registered aircraft other than ultra-lights, slightly lower than last year's total of 33, but unchanged from the 5-year average of 30. The number of fatalities (57), while up from the 2012 total of 54, was slightly lower than the 5-year average of 59, and the number of serious injuries (19) was substantially lower than the 2012 total of 39 and the 5-year average of 36.

In 2013, 10 accidents involved foreign-registered aircraft in Canada, with 2 fatal accidents resulting in 2 fatalities.

In 2013, a total of 685 incidents were reported in accordance with the TSB mandatory reporting requirements. This is an 8% increase from the 2012 total of 636, but a 10% decrease from the 5-year average of 761.

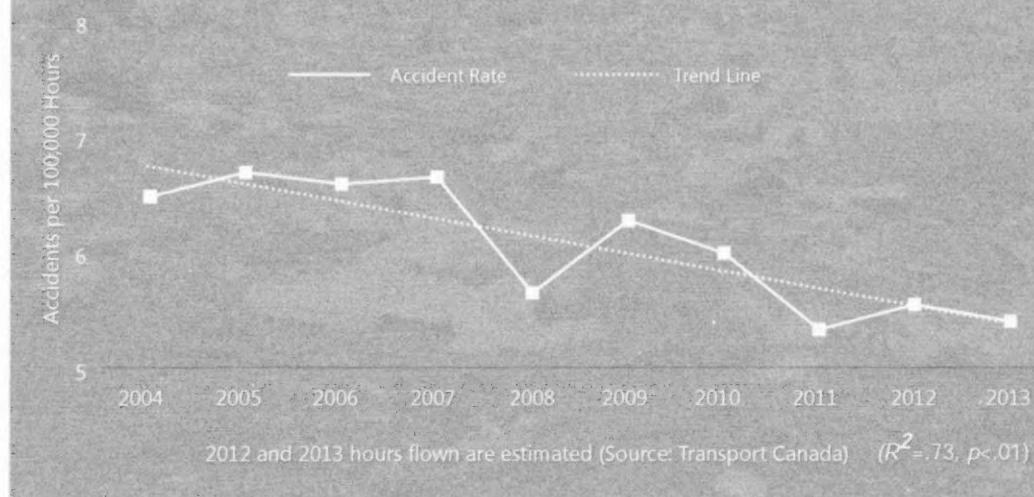
**Figure 11: Aviation occurrences**



### Accident rate

One indicator of air transportation safety in Canada is the aircraft accident rate (Figure 12). According to data provided by Transport Canada (TC), the estimate of flying activity for 2013 is 4,261,000 hours. The accident rate in 2013 was 5.4 accidents per 100 000 flying hours, down from the 2012 rate of 5.5. There has been a downward trend in the accident rate for Canadian-registered aircraft over the past 10 years.

**Figure 12: Canadian-registered aircraft accident rate**



## Investigations

A total of 20 air investigations were started in 2013–2014, and 42 investigations were completed. This represents an increase in the number of investigations completed compared to the previous year (24).

The average duration of completed investigations was 639 days, up from the 2012–2013 average of 555 days and the previous 5-year average (474 days). This increase resulted from the complexity of

a few large investigations, the workload in completing some older investigations, as well as delays in staffing vacant positions.

**Table 6: Aviation Investigations at a glance**

	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013	2013–2014
Investigations started	43	36	40	35	27	20
Investigations completed	46	50	38	28	26	42
Average number of days to complete investigations	431	431	504	447	549	639
Recommendations	1	6	6	0	2	4
Safety advisories	13	9	6	5	5	1
Safety information letters	8	2	3	0	2	0

## Recommendations and progress

In 2013–2014, the Board reassessed responses to 37 recommendations issued since 1990. Four new air safety recommendations from 3 separate investigations (A11W0048, A12O0071, and A11H0002) were also made this year.

Movement on TSB's aviation recommendations has proven challenging. In Canada, we continue to see the same causes and contributing factors year after year—causes and contributing factors that relate directly to outstanding TSB recommendations. Despite this overall trend, there has been some success on a limited number of recommendations.

The status of 5 recommendations has changed to Fully Satisfactory and those files (A90-93, A90-94, A07-08, A12-01, and A12-02) have been closed. Indeed, 2 of these recommendations date back to 1990—the TSB's first year of operations.

Of the remaining 32 recommendations, 4 were closed after being superseded by later recommendations (A91-13, A94-04, A95-11 and A95-12), the status of 2 has changed to Unable to Assess (A01-03 and A13-01) due to inadequate information received from TC, 3 recommendations have been assessed as Satisfactory in Part, 14 recommendations have

been assessed as Satisfactory Intent, 2 recommendations (A06-09 and A06-10) remain Unsatisfactory, 1 recommendation concerning emergency egress from seaplanes has been downgraded to Unsatisfactory (A11-05,) and 6 recommendations (A03-08, A06-08, A07-01, A07-07, A08-01 and A08-02) have been classified as Dormant.

The slow pace of risk reduction in the aviation industry is a troubling recurring theme, and the Board continues to press hard for improvement in the uptake of its recommendations.

"Over the last 10 years, accidents involving controlled flight into terrain, or CFIT, have accounted for just 3% of aviation accidents, but almost 18% of all fatalities."

Joseph Hincké  
TSB Board Member



## Recommendation A13-01

On 31 March 2011, the turbine-powered DHC-3 Otter, operated by Black Sheep Aviation and Cattle Co. Ltd., was flying from Mayo to the Rackla Airstrip in the Yukon, a 94-mile flight. Approximately 19 minutes after departure, an emergency locator transmitter signal was received and a search and rescue helicopter was dispatched. A few hours later the wreckage was located on a hillside 38 nm northeast of Mayo. The aircraft broke up in flight and the pilot, who was the sole occupant, died. The investigation found that the aircraft departed controlled flight for reasons which could not be determined, and broke up due to high speed.

Given the combined accident statistics for CARs subparts 702, 703, and 704 operations, there is a compelling case for industry and the regulator to proactively identify hazards and manage the risks inherent in these operations.

In order to manage risk effectively, they need to know why incidents happen and what the contributing safety deficiencies may be.

Moreover, routine monitoring of normal operations can help these operators both improve the efficiency of their operations and identify safety deficiencies before they result in an accident. In the event that an accident does occur, recordings from lightweight flight recording systems would provide useful information to enhance the identification of safety deficiencies in the investigation. The Board therefore recommended that:

*The Department of Transport work with industry to remove obstacles to and develop recommended practices for the implementation of flight data monitoring and the installation of lightweight flight recording systems by commercial operators not currently required to carry these systems.*

### Transport Canada response to Recommendation A13-01

Following a review of the risk assessment, TC supports the TSB's recommendation and has decided to proceed with the development of an Advisory Circular in 2015/16 to describe recommended practices regarding flight data monitoring

(FDM) programs. In addition, the Department will consider adding FDM principles in future regulatory initiatives/amendments, which will be consulted through focus groups at that time.

### Board assessment of Transport Canada's response to Recommendation A13-01

The Board notes TC's commitment to proceed with the development of an Advisory Circular and to consider adding FDM principles in future regulatory initiatives/amendments. However, TC is silent on the issues of removing obstacles around the installation of lightweight flight data recording systems. Further, TC has not indicated how it will work

with industry on these issues.

Given the paucity of information received from TC, the Board is Unable to Assess TC's response.



## Recommendation A13-02

On 25 May 2012, a de Havilland Beaver floatplane, operated by Cochrane Air Service, crashed following an aborted landing on Lillabelle Lake in northern Ontario. When gusty conditions prevented the plane from settling on the water, the pilot initiated a "go-around." But as the pilot applied full power and began to climb, the airspeed

dropped suddenly. The aircraft yawed to the left and rolled. This likely led to an aerodynamic stall and, with insufficient altitude to regain control, the aircraft flipped over, struck the water and was partially submerged. All three people onboard survived the initial impact, but only one person was able to successfully escape; the other two drowned.

The TSB has found that the risk of drowning for occupants involved in seaplane accidents is high. The Board therefore recommended that:

*The Department of Transport require underwater egress training for all flight crews engaged in commercial seaplane operations.*

### Transport Canada response to Recommendation A13-02

In its response, TC indicated that it will amend the current mandatory emergency training to include initial and recurrent underwater egress training for commercial seaplane flight crews and that this proposed regulation will be pre-published in the *Canada Gazette* in summer 2014.

### Board assessment of Transport Canada's response to Recommendation A13-02

This could substantially reduce or eliminate the safety deficiency. However, for the present, the action has not yet been sufficiently advanced to reduce the risks to transportation safety.

The Board therefore assessed TC's response as Satisfactory Intent.

## Recommendation A13-03

The TSB found that shoulder harnesses would have improved the chances for survival in this seaplane accident. If restrained and protected during the impact sequence, occupants may maintain consciousness and stand a better

chance of successfully exiting a sinking aircraft. The use of a three-point safety restraint (safety belt and shoulder harness) is known to reduce the severity of upper body and head injuries and more evenly distribute impact forces. The Board

therefore recommended that:

*The Department of Transport require that all seaplanes in commercial service certificated for 9 or fewer passengers be fitted with seatbelts that include shoulder harnesses on all passenger seats.*

### Transport Canada response to recommendation A13-03

TC responded that it has devoted significant effort to seaplane safety. In 2006, a risk assessment team met to analyze the risks associated with egress from submerged aircraft and to identify potential risk-reduction measures. The team's analysis showed that making shoulder restraints available to all occupants would not reduce the risks by any significant factor. Furthermore,

TC formed a focus group in 2011 to determine the best mitigation strategy to improve levels of safety for commercial seaplane operations in an effective and sustainable way. The group discussed the use of shoulder harnesses but concluded other measures offered more promise than mandating shoulder harnesses. TC further stated that most of the aircraft structures are not robust enough to support

shoulder restraints in a crash and may hinder egress.

Since it deems fleet-wide installation of shoulder harnesses not feasible, TC indicated that it will continue its efforts at safety education and promotion. In this light, TC published a Civil Aviation Safety Alert (CASA) on Safety Belts, and an article in the Aviation Safety Letter (ASL) Issue 4/2013 titled "Shoulder Harnesses and Seat Belts—Double Click for Safety." TC will also be revising Advisory Circular (AC) 605-004 Use of Safety Belts by Passengers and Crew Members.

"In an emergency, you only have seconds to orient yourself and get out of a submerged aircraft. Underwater egress training can make a real difference, and pilots who have this training stand a better chance of getting out."

Kathy Fox  
TSB Board Member



### **Board assessment of Transport Canada's response to Recommendation A13-03**

Because TC's response does not contain details of any action which has been taken or proposed that will reduce or eliminate the safety deficiency, the deficiency will continue to put persons at risk.

The Board therefore assessed TC's response as Unsatisfactory.

### **Recommendation A14-01**

On 20 August 2011, a Boeing 737-210C, operated by First Air, was being flown as a charter flight from Yellowknife, Northwest Territories, to Resolute Bay, Nunavut, when it struck a hill about 1 nm east of the runway. The accident claimed the lives of all 4 crew members and 8 of the passengers, and left 3 passengers seriously injured.

The investigation concluded that a combination of factors contributed to the accident. The aircraft did not intercept the runway localizer (alignment) beam, and instead diverged to the right, and ultimately hit a hill. Fundamental to the Board's findings is the fact that an

unstable approach was continued to a landing.

Unstable approaches continue to be a high risk to safe flight operations in Canada and worldwide. Current defenses against continuing unstable approaches have proven less than adequate. In Canada, while many CAR 705 operators have voluntarily implemented Flight Data Management (FDM) programs, there is no requirement to do so. First Air was not conducting FDM at the time of this accident. Furthermore, FDM programs must specifically look at why unstable approaches are occurring, how crews handle them,

whether or not crews comply with company stabilized-approach criteria and procedures, and why crews continue an unstable approach to a landing.

Unless further action is taken to reduce the incidence of unstable approaches that continue to a landing, the risk of approach and landing accidents will persist. Therefore, the Board recommended that:

*Transport Canada require CARs Subpart 705 operators to monitor and reduce the incidence of unstable approaches that continue to a landing.*

### **Transport Canada response to recommendation A14-01**

This recommendation was issued on 25 March 2014, and the Minister of Transport has 90 days to respond. Therefore, as of 31 March 2014, the response to this recommendation was not yet received.

## **Aviation highlights**

### **Stall warning systems for DHC-2 aircraft**

On 25 May 2012, a de Havilland Beaver floatplane crashed into Lillabelle Lake in northern Ontario, killing 2 of the 3 people on board. One of the issues arising from the TSB's subsequent investigation involved stall warnings.

Current regulations require that aircraft certified in the normal, utility, aerobatic, or commuter category be designed with a clear and distinctive stall warning. The stall warning may be furnished either through inherent aerodynamic qualities of the aeroplane or by a device that gives clearly distinguishable indications.

When the DHC-2 was certified, a stall warning system was not included, as it was determined that the aircraft had a natural aerodynamic buffet at low airspeeds and high angles of attack, and that this characteristic provided a clear and distinctive warning of an impending stall. However, if a pilot does not recognize buffeting or misinterprets it as turbulence while at a low airspeed or high angle of attack, there is a risk that the warning of impending stall will go unrecognized. A stall warning system that provides visual, aural, or tactile warning can therefore give pilots a clear and compelling warning.

A large number of DHC-2 aircraft operate in Canada. Moreover, stalls encountered during critical phases of flight often have disastrous consequences. Therefore, the Board is concerned that the aerodynamic buffet of DHC-2 aircraft alone may provide insufficient warning to pilots of an impending stall.

## Crew resource management

One of the issues arising from the TSB's investigation of the accident in Resolute Bay was crew resource management (CRM).

During every flight, pilots must successfully interact with each other, with their aircraft, and with their environment to effectively manage threats, errors, or undesired aircraft states that may be encountered. Flight crews employ a variety of strategies to help improve effectiveness. CRM is a defence against risks present in all phases of flight, including unstable approaches. Some pilots may not adequately manage operational risk as a result of ineffective CRM skills.

Although there are a variety of CRM standards and regulations throughout the world, there is consensus within the aviation

community that programs should consist of 3 distinct phases: indoctrination and awareness training; practice, feedback, and recurrent training; and continuing reinforcement.

In Canada, the current standard for CRM training does not incorporate the more modern concept of threat-and-error management, nor are certain levels of experience, training, or accreditation needed to teach CRM. By contrast, the United Kingdom Civil Aviation Authority (CAA) has established a series of stringent accreditation requirements for CRM instructors and instructor examiners.

In 2012, however, a focus group consisting of TC and industry representatives proposed components of a contemporary

CRM training standard for Part VII commercial operators, and the Civil Aviation Regulatory Committee (CARC) subsequently directed that a contemporary CRM training regulation and standard should be developed for CARs Subparts 702, 703, 704, and 705.

It is not yet known how TC's new standard will compare to the existing standard, nor when it will take effect. Nor is it known how TC will verify that operators apply the new training standard to ensure that flight crews acquire and maintain effective CRM skills.

The Board, therefore, is concerned that, without a comprehensive and integrated approach to CRM by TC and aviation operators, flight crews may not routinely practise effective CRM.

## Relying solely on the see-and-avoid principle to avoid collisions

On 28 May 2012, a Beechcraft V35B Bonanza was operating under visual flight rules (VFR) in the vicinity of Warrenton, Virginia, when it collided with a Piper PA-28-140 that was also operating under VFR. The Beechcraft broke up in flight, and the pilot and flight instructor were fatally injured. The pilot of the Piper, who was the sole occupant of the aircraft, sustained injuries but was able to conduct a forced landing.

The accident demonstrated yet again that relying solely on the see-and-avoid principle to prevent collisions between aircraft operating under VFR in congested airspace is inadequate.

A number of international studies have addressed the overall issue of the effectiveness of the see-and-avoid principle, as well as the risks of collision associated with this principle. All acknowledged the underlying physiological limitations at play and that, when mid-air collisions occur, "failure to see and avoid is due almost entirely to the failure to see."

As VFR traffic increases, additional defences should be considered to reduce the risk of mid-air collision. These defences could include changes in airspace classification and increased air traffic control (ATC) intervention, as well as ground-based and on-board technology capable of directly alerting pilots of the proximity of conflicting traffic.

# Appendix A – Reports released in 2013-2014

This Appendix provides an overview of investigation reports released and, if applicable, an overview of the safety actions taken.

For a more comprehensive list of safety actions taken, please see the final investigation reports.

## Marine

Date / location	Report	Vessel	Type	Event
24 November 2011 Grand Banks of Newfoundland, NL	M11N0047	<i>Maersk Detector/</i> <i>GSF Grand Banks</i>	Supply Vessel and mobile offshore drilling unit	Striking
Safety Action Taken				
<b>Maersk Supply Service Canada Ltd.</b> implemented bridge resource management training, developed and implemented safety guidelines and updated the ship's voyage data recorder.				
<b>Husky Oil Ltd.</b> provided access to continuous up-to-date weather forecasting and implemented operating guidelines and continued education.				
<b>Canada - Newfoundland and Labrador Offshore Petroleum Board (CNLOPB)</b> requested that the Marine Operations Manual, Safety Case, and Emergency Response Plan for the mobile offshore drilling unit <i>GSF Grand Banks</i> be updated. These requests are being actioned by Transocean Ltd. It also conducted marine operations audits on board both the <i>Henry Goodrich</i> and the <i>GSF Grand Banks</i> .				
10 February 2012 Cape Freels, NL	M12N0003	<i>Katsheshuk II</i>	Fishing Vessel	Accidental death
Safety Action Taken				
<b>Katsheshuk Fisheries, Ltd.</b> has modified the access to the shrimp holding tank on the <i>Katsheshuk II</i> to improve safety and ensured that safety measures are in place with respect to the holding tank door system on its other vessels. The company has also instituted confined space entry training for crew.				
04 May 2012 Cape Beale, Vancouver Island, BC	M12W0054	<i>Jessie G</i>	Fishing Vessel	Capsizing and grounding
Safety Action Taken				
<b>Pacific Prawn Fisherman's Association (PPFA)</b> assembled a committee to work with Fish SAFE to develop a code of best practices for the BC prawn fishery to address unsafe work practices; the code was approved by the PPFA board and distributed to fishermen in early 2013.				
09 May 2012 Banks Island, Hecate Strait, BC	M12W0062	<i>Pacific Siren</i>	Fishing Vessel	Capsizing and sinking
Safety Action Taken				
<b>Pacific Prawn Fisherman's Association (PPFA)</b> assembled a committee to work with Fish SAFE to develop a code of best practices for the BC prawn fishery to address unsafe work practices. The code was approved by the PPFA board and distributed to fishermen in early 2013.				

Date / location	Report	Vessel	Type	Event
30 May 2012 Portugal Cove, NL	M12N0017	<i>Beaumont Hamel</i>	Passenger Vessel	Striking
<b>Safety Action Taken</b>				
The Department of Transportation and Works of Newfoundland and Labrador (DTW) has installed a computerized maintenance-management system on the <i>Beaumont Hamel</i> and in the company office. An electrical contractor has also made modifications to the <i>Beaumont Hamel</i> including the installation of a load-sharing alarm and power-shedding system, the installation of an automatic start system for the standby generators, and the overhaul and calibration of the generator engine fuel pumps.				
<b>Safety Action Taken</b>				
03 June 2012 Sechelt Rapids, BC	M12W0070	<i>Lewis-McPhee</i>	Fast Rescue Craft	Loss of life
<b>Safety Action Taken</b>				
Royal Canadian Marine Search and Rescue (RCM-SAR) has required that all units operating vessels with self-righting systems undergo inspection and maintenance and be re-certified by authorized certified dealers or installers. Voyages of member vessels in the rapids have been limited to emergencies and only under the conduct of coxswains certified in Rigid Hull Inflatable Operator Training (RHIOT). New restrictions for training exercises were implemented, including the prohibiting of training voyages where currents exceed 10 knots during ebb and flow tides.				
29 July 2012 Trois-Rivières, QC	M12L0095	<i>Common Spirit</i>	Bulk Carrier	Striking
<b>Safety Action Taken</b>				
Corporation des Pilotes du St-Laurent Central (CPSLC) sent the pilot for further simulator training to practice exercises such as bringing vessels alongside.				
06 August 2012 Gulf of St. Lawrence, QC	M12L0098	<i>Bulk Japan / Wilf Seymour / Alouette Spirit</i>	Bulk Carrier / Tug / Barge	Risk of collision
28 September 2012 La Push, Washington, U.S.	M12F0011	<i>Viking Storm / Maverick</i>	Fishing Vessel / Fishing Vessel	Collision
11 October 2012 Kingsville Harbour, ON	M12C0058	<i>Jiimaan</i>	Roll/on Roll/off Passenger Vessel	Grounding
<b>Safety Action Taken</b>				
Transport Canada advised its regional directors of programs to ensure that water depths are accurate in navigational charts and in sailing directions. Regional managers have been advised to work with the Canadian Hydrographic Service or the Canadian Coast Guard to modify charts/directions or issue Notices to Mariners or Notices to Shipping.				
Owen Sound Transportation Company has improved procedures for mustering and accounting of passengers on all its vessels. Cross track limit lines corresponding to the boundaries of the Kingsville approach channel have been added to the <i>Jiimaan</i> 's electronic chart system and water level monitoring procedures have been developed and implemented.				

Date / location	Report	Vessel	Type	Event
25 October 2012 Chesterfield Narrows, NU	M12H0012	<i>Nanny</i>	Tanker	Grounding

Safety Action Taken

**Coastal Shipping Limited** has initiated a confined waters policy that requires, among other things, that a Confined Waters Checklist be completed prior to entering a waterway to prevent groundings or collisions. The company has also installed a new electronic charting system (ECS), enhanced its personnel training plan, and instituted voyage data recorder (VDR) training.

07 December 2012 Robert Banks, BC	M12W0207	<i>Cape Apricot</i>	Bulk Carrier	Striking
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Safety Action Taken

**Pacific Pilotage Authority** has developed a post-incident protocol that clearly identifies the actions to be taken following an occurrence.

23 April 2013 Esquimalt, BC	M13W0057	<i>American Dynasty</i>	Fishing Vessel	Striking
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Safety Action Taken

**American Seafoods Company, LLC** has made several modifications to the configuration of the *American Dynasty*, including ensuring that the emergency generator is configured to start automatically, replacement of the non-functional set of emergency back-up batteries, and replacement of the pitch control actuator. The company has also carried out extensive pitch control testing.

**Rolls-Royce** has installed a larger pitch actuator valve with an increased holding force and resistance against uncontrolled pitch movement on the vessel's controllable pitch propeller in the event of a total electrical failure.

## Pipeline

Date / location	Report	Company	Event
23 June 2012 Fort St. John, BC	P12H0103	Westcoast (Spectra) Energy, Compressor Station N4	There was a leak of natural gas from the stem of an isolation valve, which resulted in a flash fire.

### Safety Action Taken

**Westcoast** conducted a natural-gas-leak survey at all facilities. An enhanced leak-reporting process was implemented. Leak notifications, which are now reviewed weekly, are coded to enable tracking of the repair.

All valve enclosures have been audited and updated to a new design standard. The valve-enclosure entry procedure was updated. Deficiencies in internal-atmosphere test ports and required signage were corrected.

The workplace hazard prevention program was revised.

28 June 2012 Fort St. John, BC	P12H0105	Westcoast (Spectra) Energy Nig Creek pipeline	A pipeline transporting sour gas ruptured. There was ignition and a fire, which spread to adjacent forested areas.
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### Safety Action Taken

**Westcoast** conducted a successful pressure test on the entire Nig Creek pipeline. A monitoring and verification plan for the pipeline's fitness for service was filed. Metallurgical analysis of other segments of the pipeline was performed and additional pipeline inspection was conducted.

## Rail

Date / location	Report	Company	Event
27 December 2011 Moberly, BC	R11V0257	Canadian Pacific Railway	Main-track derailment
18 January 2012 Hanlon, AB	R12E0004	Canadian National	Runaway/Collision
Safety Action Taken <b>Canadian National</b> issued a bulletin regarding the application of handbrakes and installed special derails at the Hanlon siding to be used when unattended cars are left in the siding.			
26 February 2012 Burlington, ON	R12T0038	Via Rail Canada Inc.	Main-track derailment
Safety Action Taken See Board Recommendations R13-01, R13-02, and R13-03 for assessment of Transport Canada (TC) responses on pages 27-28.			
21 April 2012 Bowden, AB	R12C0051	Canadian Pacific Railway	Main-track derailment and collision
29 July 2012 Poplar Point, MB	R12W0165	Canadian Pacific Railway	Main-track derailment,
Safety Action Taken <b>Canadian Pacific Railway (CP)</b> amended its Severe Weather Warning Procedure to ensure that all severe thunderstorm warnings will be reviewed. If there is any mention of a high wind threat (i.e., greater than 90 km/h), the duty meteorologist will resend the e-mail warning, labelled as "Wind Warning" in the advisory header, and will call the CP operation centre emergency line to provide a verbal update.			
09 August 2012 Broadview, SK	R12W0182	Canadian Pacific Railway	Collision at crossing
Safety Action Taken TC is promoting the development of a hybrid active warning system that will be low cost and applicable to less traversed passive public crossings.			
09 August 2012 Hegadom, QC	R12Q0030	VIA Rail Canada Inc.	Misaligned switch and track diversion
Safety Action Taken <b>Canadian National</b> issued a supplement to <i>Canadian Rail Operating Rules</i> , Rule 104(q) where employees need to write the time of day, location of the switch, initials of employees that either handled or confirmed the position of switch, and position the switch was left, on the back of their clearance when handling a main track switch in Occupancy Control System. In addition, the managers conducted blitz campaigns to ensure compliance with safety standards.			
13 September 2012 Montréal, QC	R12D0063	Agence métropolitaine de transport (AMT)	Unprotected overlap of authority
Safety Action Taken Replacement of the old Code System of traffic control, as part of the AMT upgrade project, has been scheduled for 2015 in a cost-sharing arrangement between the Seaway Interlocking and AMT, with CP doing the work.			

Date / location	Report	Company	Event
01 December 2012 London, ON	R12T0217	Canadian Pacific Railway	Pedestrian fatality
<b>Safety Action Taken</b>			
The <b>City of London</b> ordered the removal of brush along the right-of-way in the vicinity of crossings within city limits. At the accident area, fencing was repaired, and signage was erected.			
Transport Canada is updating the <i>Pedestrian Safety at Grade Crossing Guide</i> to provide improved guidance to municipalities on pedestrian crossing safety.			
09 January 2013 Joliette, QC	R13D0001	VIA Rail Canada Inc.	Crossing collision
<b>Safety Action Taken</b>			
Under the TC Grade Crossing Improvement program, incandescent signal lights were replaced with LEDs to improve the visibility of flashing lights at crossing. This crossing has been put on the list of crossings to be considered for flashing yellow advanced crossing signal lights.			
11 January 2013 Mai, QC	R13Q0001	Quebec North Shore and Labrador Railway (QNS&L)	Collision and derailment
<b>Safety Action Taken</b>			
TC issued two Notices of Danger to QNS&L. The first Notice cited the risk of operating a locomotive without <i>Canadian Railway Operating Rules</i> qualification. The second Notice cited the risk of having an engineer trainee operate a locomotive on his own.			
TC has increased supervision of QNS&L operations and audited QNS&L's safety management system (SMS) with a focus on the training programs for locomotive engineers and engineer instructors, supervision of engineers and engineer trainees, and the corrective actions implemented in the wake of this accident.			
28 April 2013 Provost, AB	R13E0069	Canadian Pacific Railway	Main Track Derailment

## Aviation

Date / location	Report	Aircraft	Event
16 June 2010 Ottawa/MacDonald-Cartier International Airport, Ottawa, ON	A10H0004	Embraer EMB-145LR	Runway overrun

Safety Action Taken

**Trans-States Airlines** has made changes to clarify flap settings to be used when landing on wet or contaminated runways.

The Ottawa International Airport Authority resurfaced Runway 07/25 and corrected its shape to improve drainage. At the same time, it built 300-metre runway end safety areas as per the TSB's Watchlist recommendation and ICAO's recommended practice. It is the first airport in Canada to do so.

TC has published information and guidance regarding runway surface grooving.

29 July 2010 Lillooet, BC	A10P0242	Bell 214B-1 Helicopter	Loss of engine power and landing rollover
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Safety Action Taken

**Transwest Helicopters Limited** has reduced the time between overhaul of all fuel control units to 1800 hours.

Following its root-cause corrective action process, **Honeywell USA** issued 2 service bulletins for the misidentified FCUs, reducing the time between overhauls from 2400 hours to 1800 hours, and later recalled all these FCUs.

30 November 2010 Pierre Elliott Trudeau International Airport, Montréal, QC	A10Q0213	Boeing 737-823	Runway excursion
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Safety Action Taken

**American Airlines** introduced a simulation and discussion of this Boeing 737 runway excursion. This training is given to company pilots to educate them on the possibility of a runway excursion due to a nose wheel steering problem on landing roll-out after a normal approach and landing.

12 March 2011 Iqualuit, NU	A11Q0052	Bombardier BD100-1A10	Runway excursion
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Safety Action Taken

**Bombardier** conducted a series of tests and is in the process of issuing a service bulletin to require a one-time check of the electro hydraulic servo valve (EHSV) electrical servo motor. Bombardier has also introduced a new EHSV configuration that has an O-ring seal between the connector and valve cap to seal from moisture ingress.

31 March 2011 Mayo, YT	A11W0048	de Havilland DHC-3 Otter	Loss of control – In-flight breakup
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Safety Action Taken

The **Federal Aviation Administration (FAA)** issued an Airworthiness Directive (AD). The AD imposed a maximum operating speed (VMO) of 144 mph for DHC-3 Otter land/ski aircraft and 134 mph (VMO) for DHC-3 Otter seaplanes.

The FAA issued an AD that applied to all Viking Air Limited Model DHC-3 Otter airplanes requiring new repetitive inspections to the elevator control tabs.

**Black Sheep Aviation & Cattle Co. Ltd.** improved its record-keeping of flight duty times.

Date / location	Report	Aircraft	Event
15 April 2011 Vancouver International Airport, Richmond, BC	A11P0073	de Havilland DHC-8-311 and Boeing 737 700	Loss of separation
<b>Safety Action Taken</b> <b>NAV CANADA</b> Vancouver control tower management issued an Operations Bulletin to cancel the use of intersection departures at CYVR. Management is also working on changing the missed-approach procedures to ensure aircraft that conduct a last-second missed approach have a greater safety margin. Fatigue Management Program initiatives are also currently underway.			
05 July 2011 Harrison Lake, BC	A11P0106	Cessna 152	Aerodynamic stall and collision with terrain
<b>Safety Action Taken</b> <b>Pacific Flying Club</b> implemented a series of safety actions such as the suspension of mountain-flying instruction pending review and analysis using safety management system (SMS) principles; modifications to the mountain-flying program; mandatory written test on mountain-flying awareness; and portable global positioning system (GPS) to be carried on all flights outside Lower Mainland.			
18 July 2011 La Tuque, QC	A11Q0136	Cessna A185E	Engine stoppage and forced landing on water
<b>Safety Action Taken</b> <b>Air Tamarac</b> has implemented new safety measures: all floatplane occupants are now required to wear a personal flotation device; passenger safety briefings must be provided before engine start-up; and pilot training now includes initial mandatory training in underwater evacuation from a submerged aircraft, as well rescue training.			
23 July 2011 St. John's, NL	A11H0001	Sikorsky S-92A	Inadvertent descent during departure
<b>Safety Action Taken</b> <b>Cougar Helicopters</b> has improved its unusual attitude training and now requires pilots to fly a minimum of 2 manually flown instrument approaches every 90 days. It has also clarified its standard operating procedures related to unusual attitude recovery, subtle incapacitation, and autopilot usage.			
31 July 2011 Stewart, BC	A11P0117	Bell 407 Helicopter	Main-rotor strike and collision with terrain
<b>Safety Action Taken</b> <b>VIH Helicopters Ltd.</b> has undertaken efforts to work with manufacturers of flight data monitoring systems to develop and test vendor hardware and software that would further meet the needs of VFR helicopter operations.			
20 August 2011 Resolute Bay, NU	A11H0002	Boeing 737-210C	Controlled flight into terrain
<b>Safety Action Taken</b> <b>First Air</b> has clarified standard operating procedures for all of their fleet. The company has stressed the importance of adhering to SOPs and eliminating adaptations in line operations. The company has also enhanced its flight data monitoring program to detect SOP adaptations and other areas requiring training enhancement.			
<b>The Royal Canadian Air Force</b> now includes a senior air traffic control officer in the leadership team that deploys in support of expeditionary air traffic management initiatives.			
<b>TC</b> conducted a series of inspections of First Air. The department noted certain deficiencies and First Air submitted corrective action plans to address these. Subsequent inspections have confirmed effectiveness of corrective actions.			
<b>NAV CANADA</b> updated information in its navigational products, including updating magnetic variation at all northern sites.			

Date / location	Report	Aircraft	Event
27 August 2011 Saint-Ferdinand, QC	A11Q0168	Robinson R44 Raven II	Collision with terrain following night-time takeoff

Safety Action Taken

The **Canadian Beacon Registry** sent a letter to all owners of emergency beacons asking them to review the information provided, make the necessary corrections and provide the missing information.

29 August 2011 Pierre Elliott Trudeau International Airport, Montreal, QC	A11Q0170	de Havilland DHC-8-402 and Beech A100 King Air	Risk of collision
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Safety Action Taken

**Sky Regional Airlines** has modified its checklists to reduce distractions while taxiing and issued safety bulletins to ensure crews follow standard operating procedures (SOPs) to prevent runway incursions.

The **Montréal/Pierre Elliott Trudeau Airport** has improved signage on Taxiway Echo on either side of Runway 28 and established a local runway safety committee.

**NAV CANADA** has implemented several procedures, specified in its Air Traffic Control Manual of Operations to reduce the use of Runway 10/28 in order to reduce runway incursions.

04 September 2011 Ottawa/Macdonald-Cartier International Airport, Ottawa, ON	A11H0003	Embraer EMB-145LR	Runway Excursion
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Safety Action Taken

The **Ottawa International Airport Authority** bought two rapid deployment emergency shelters to provide shelter from the elements following an emergency evacuation. The airport also plans to undertake a complete resurfacing of Runway 14/32, including grooving the pavement and including 300m runway end safety areas (RESAs), similar as to what was done on Runway 07/25 in 2012-13.

**Embraer** made revisions to its E145 aircraft maintenance manual to clarify and ensure consistency of the information on the brake system.

27 October 2011 Vancouver International Airport, Richmond, BC	A11P0149	Beechcraft King Air 100	Loss of control and collision with terrain
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Safety Action Taken

**Northern Thunderbird Air Inc.** notified all employees regarding pilots electing to operate turbine engines on reduced (single-engine) power with a warning that certain power settings may produce undesirable or uncontrollable yaw as airspeed decreases. It also issued a standard operating procedures bulletin.

TC is working with **Pratt & Whitney Canada** to improve implementation of a Service Bulletin to mitigate the consequences of an unsecured oil filler cap.

02 November 2011 Kapuskasing, ON	A11O0205	Bell 206L	In-flight separation of main rotor blade and collision with terrain
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Safety Action Taken

TC released a Civil Aviation Safety Alert (CASA) to disseminate information relevant to owners and operators of Bell 206L series helicopters affected by Alert Service Bulletin (ASB) 206L-09-159.

TC issued an airworthiness directive (AD) that mandated blade spar radiography in accordance with Part III of the ASB. TC later revised the AD to introduce a life limit on all affected main rotor blades.

Date / location	Report	Aircraft	Event
10 December 2011 Gander, NL	A11A0101	Beech 1900D	Stuck elevator control
<b>Safety Action Taken</b>			
<b>Exploits Valley Air Services Limited</b> has required all staff to use flight control locks at any time when there is not a crew member at the controls of the aircraft. Flight crew training now incorporates the control lock issue and loss of flight control as a simulated occurrence during all flight crew training. The company also ordered the associated elevator bob-weight stop kits for its aircraft.			
The Federal Aviation Administration issued Emergency Airworthiness Directive 2011-27-51, effective immediately upon receipt.			
<b>Hawker Beechcraft Corporation</b> issued Model Communiqué #104 to announce newly developed Airliner Maintenance Manual inspection procedures intended to identify and correct noted damage to the stop bolt, the stop-bolt bracket, the bob-weight, and other supporting structures.			
14 December 2011 Ottawa/MacDonald-Cartier International Airport, Ottawa, ON	A11O0239	Ottawa Cessna 177	Loss of control and collision with terrain
09 January 2012 Fort Nelson, BC	A12W0004	Boeing 737-700	Runway overrun
<b>Safety Action Taken</b>			
<b>Enerjet</b> issued a communication to all flight crew that contained an open-book exam of the company operations manual. The goals were to raise awareness of the fatigue self-assessment tool, and reiterate the importance of making honest self-assessments of fitness for duty as well as reassuring pilots that booking off from work because of fatigue was non-punitive.			
10 January 2012 North Spirit Lake, ON	A12C0005	Piper PA31-350 Navajo Chieftain	Loss of control and collision with terrain
<b>Safety Action Taken</b>			
<b>NAV CANADA</b> has published an approved instrument approach procedure for the North Spirit Lake aerodrome.			
<b>Keystone Air Service</b> has revised its operations manual and implemented a multi-crew policy that applies to all IFR flights. It has amended its flight-training record-keeping procedures to make it easier and more efficient to prove that all required training has been completed.			
<b>Keystone Air Service</b> has updated the captain's trip report form to include provisions for progressive fuel-state monitoring and revised its operational flight plan form to include the calculated landing weight and landing centre of gravity.			
08 March 2012 London, ON	A12O0030	Cessna Citation and a Gulfstream	Loss of separation and risk of collision
17 March 2012 Blue River, BC	A12P0034	Beechcraft 1900C	Runway excursion
<b>Safety Action Taken</b>			
<b>TC</b> will develop contemporary crew resource management (CRM) and pilot decision making training standards for 702, 703, 704, and 705 operations. These standards will include the threat and error management model.			

Date / location	Report	Aircraft	Event
30 March 2012 Loder Peak, AB	A12W0031	Bell 206B JetRanger Helicopter	Loss of control and collision with terrain
<b>Safety Action Taken</b>			
<b>Kananaskis Mountain Helicopters</b> took a number of measures to reduce operational risks. These include requiring pilots to wear helmets while flying, enhancing mountain flying training and putting safeguards in place to ensure that all required training has been completed.			
12 May 2012 St. Brieux, SK	A12C0053	Piper PA-28R-200 Arrow, and Lake LA-4 200 Buccaneer	Mid-air collision
<b>Safety Action Taken</b>			
<b>NAV CANADA</b> has issued a Canada Flight Supplement amendment for the Penticton, Oliver, and Osoyoos airports in the Okanagan Valley, adding warnings to the caution sections of these airports.			
25 May 2012 Lillabelle Lake, ON	A12O0071	de Havilland DHC-2 MK 1	Loss of control and collision with water
<b>Safety Action Taken</b>			
<b>Cochrane Air Service</b> began providing a printed graphic area forecast to pilots each morning. All pilots are required to sign the printed weather report and verify that the conditions are suitable for the planned flight.			
28 May 2012 Toronto-Lester B. Pearson International Airport, Toronto, ON	A12O0074	Boeing 777-333ER	Engine failure during initial climb-out
<b>Safety Action Taken</b>			
<b>Air Canada</b> has changed its maintenance inspection procedures for the General Electric engines.			
The <b>Federal Aviation Administration</b> , the agency that certified the engine, published an Airworthiness Directive identifying the issue and drawing attention to the existing manufacturer's service bulletins that describe the mandatory procedures to be followed for engine inspection.			
28 May 2012 Warrenton, VA, U.S.	A12H0001	Beechcraft V35B and Piper PA-28-140	Mid-air collision
<b>Safety Action Taken</b>			
<b>The Federal Aviation Administration</b> has made improvements in conflict alert training for air traffic controllers. Instructors teach the trainees their responsibilities and how to react to these "Conflict Alerts." Scenarios are fabricated with built in conflicts that teach the trainee to recognize conflict points and how to react to the Conflict Alert activation. Students are taught Traffic Alert responsibilities and priority of duty requirements.			
01 June 2012 Terrace, BC	A12P0079	Eurocopter AS350-B2	Loss of visual reference and collision with terrain
<b>Safety Action Taken</b>			
<b>Bailey Helicopters Limited</b> suspended its authorization for reduced-visibility flights. It enhanced training for its pilots, including controlled flight into terrain avoidance and inadvertent meteorological condition training; implemented tools to enhance pilot decision making; and implemented a flight data monitoring program.			

Date / location	Report	Aircraft	Event
05 July 2012 Angusville, MB	A12C0084	BELL206B	Controlled flight into terrain
Safety Action Taken			
<b>Sunrise Helicopters Incorporated</b> has hired a risk manager, and a formal risk assessment is now required for every contract. All spray pilots employed by the company must have a minimum of 2000 hours of total flight time. The experience of the pilot will be matched to the demands of the contract. A mentorship program has been initiated, and a senior pilot will be on site to supervise a junior pilot for the first 50 hours of spraying operations. Spray training will be done with new pilots at both forestry and agricultural operational heights above ground.			
10 July 2012 Carcross, YT	A12W0088	Robinson Helicopter R44 II	Loss of control and collision with terrain
Safety Action Taken			
<b>Horizon Helicopters Ltd.</b> has implemented a safety policy that requires that all pilots wear flight helmets during flight operations.			
01 August 2012 Trout Lake, ON	A12C0099	Cessna 180G	Loss of control and collision with terrain
12 August 2012 Wabush, NL	A12A0085	Bell 407 Helicopter	Engine failure and hard landing
13 August 2012 Kelowna, BC	A12P0136	Piper PA-30 Twin Comanche	Collision with terrain
Safety Action Taken			
<b>NAV CANADA</b> has issued a Canada Flight Supplement amendment for the Penticton, Oliver, and Osoyoos airports in the Okanagan Valley, adding warnings to the caution sections of these airports.			
13 August 2012 Langara Island, BC	A12P0134	Sikorsky S-76A	Engine power loss and ditching
Safety Action Taken			
<b>Helijet International Inc.</b> instituted more frequent and enhanced engine inspections and replaced all of the emergency floats that were more than 14 years old.			
<b>Rolls-Royce</b> amended its inspection procedures for the M250-C30 series engine, and released a newer, stronger design for the engine casing.			
13 August 2012 St. John's International Airport, St. John's, NL	A12A0082	Ilyushin IL-76TD-90VD	Runway overrun
Safety Action Taken			
<b>Volga-Dnepr Airlines</b> is working with Tashkent Aircraft Production Company to resolve the discrepancy in the brake line installation. The airline also introduced requirements that flight crews monitor the heading and wind speed and that a go-around be carried out whenever the tail wind limitations have been exceeded. It also requires the captain to decide on using reverse thrust on all 4 engines in special cases.			
<b>St. John's International Airport Authority</b> performed runway texture improvement work (runway re-texturing) to increase runway friction.			

Date / location	Report	Aircraft	Event
24 August 2012 Moorefield, ON	A12O0138	Cessna 172S	Collision with terrain
<b>Safety Action Taken</b>			
Waterloo-Wellington Flying Club (WWFC) re-emphasized to all pilots the difference between operations in the "Normal" and "Utility" categories as well as the WWFC policies regarding the requirement that an instructor be on-board to perform air work; strengthened the air work component of their ground school programs; and will equip its entire fleet with a global positioning system (GPS) tracker and a cockpit voice recorder.			
26 August 2012 Clareholm, AB	A12W0121	Cessna 172 M	Loss of control and collision with terrain
08 October 2012 Renfrew, ON	A12O0170	SOCATA TBM 700N	Loss of control and collision with terrain
16 October 2012 Pickle Lake, ON	A12C0141	Lake 250	Collision with terrain
10 February 2013 Waskada, MB	A13C0014	Cessna 210C	Continued visual flight into instrument meteorological conditions and collision with terrain
29 May 2013 Fort McMurray, AB	A13W0070	Bell 206B	Loss of tail rotor effectiveness and collision with terrain

**Safety Action Taken**

**Wood Buffalo Helicopters** has instituted a change to its training forms to document that loss of tail rotor effectiveness instruction (LTE) was completed during its technical ground training and flight training programs. The company also conducted an LTE awareness campaign after this accident through a company safety meeting as well as through the creation and distribution of an operations bulletin on LTE and the hazards related to slow and low flight.

# Appendix B – Glossary

Accident	In general, a transportation occurrence that involves serious personal injury or death, or significant damage to property, in particular to the extent that safe operations are affected (for a more precise definition, see the <i>Transportation Safety Board Regulations</i> )
Incident	In general, a transportation occurrence whose consequences are less serious than those of an accident, or that could potentially have resulted in an accident (for a more precise definition, see the <i>Transportation Safety Board Regulations</i> )
Occurrence	A transportation accident or incident
Recommendation	A formal way to draw attention to systemic safety issues, normally warranting ministerial attention
Safety concern	A formal way to draw attention to an identified unsafe condition for which there is insufficient evidence to validate a systemic safety deficiency but the risks posed by this unsafe condition warrant highlighting
Safety advisory	A less formal means for communicating lesser safety deficiencies to officials within and outside the government
Safety information letter	A letter that communicates safety-related information, often concerning local safety hazards, to government and corporate officials